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ABSTRACT

This volume presents 22 papers that discuss thinking in the context of subjects taught in general education, special and vocational education, educational technology, and special programs. The key note article is: (1) "A Case for Higher Order Thinking" (G. Garcia Jr.). Under the heading "Educational Technology" are: (2) "Designing a Successful Problem Solving Inservice" (T. Boudrot); and (3) "Software to Encourage Problem Solving" (T. Boudrot). Under "General Education" are: (4) "Psychomotor Skills: The Discovered Element of Thinking" (D. Thrasher); (5) "Teaching Adolescents about Communicating in Families" (C. Klein); (6) "Thinking Skills and Driver Education: A Natural Partnership" (G. Peavy); and (7) "Thinking about Acting" (K. Wheetley). Under "Special Education" are: (8) "Learning To Learn: Executive Control Strategies for Handicapped Students" (A. Smisko); and (9) "The Use of Graphic Organizers with Hearing-Impaired Students" (S. Cowan). Under "Special Programs" are: (10) "Developing the Thinking of Compensatory Students" (A. Pedroza); and (11) "Developing the Thinking of Students of Limited English Proficiency" (E. Gutierrez). Under "Vocational Education" are: (12) "Developing Critical Thinking Skills in the Health Occupations Laboratory" (J. Keeton); (13) "Improving Trade and Industrial Student Thinking Skills" (J. Cogdell); (14) "Send Us Your Thinkers" (B. Sullivan); (15) "Teaching Thinking in Industrial Technology Education" (N. Ballard); and (16) "Thinking through Vocational Home Economics Education" (J. Hetherly). Under "Thoughts across the State" are: (17) "Accelerating Learning Potential" (V. Post); (18) "A Shortcut to Understanding and Teaching Higher Level Thinking Skills" (M. Rice); (19) "Developing Thinking through Problem-Solving Programs" (E. Forte et al.); (20) "Principals: Taking the Lead in Thinking Skills" (C. Collins); (21) "Teaching Slower Learners Higher Level Thinking" (C. Marshall); and (22) "Vocational and Academic Education Join Hands To Nurture Student Thinking" (M. Hendrix). (SLD)

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REACH

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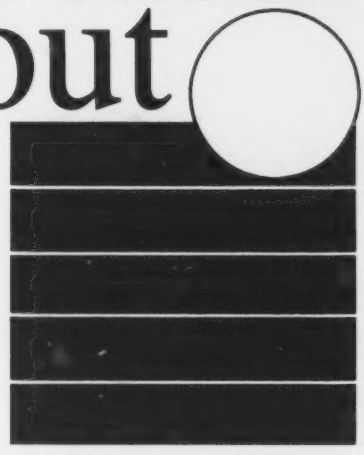

A Collection of Articles on Higher Order Thinking Skills

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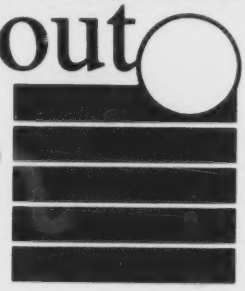

VOLUME III, PART II

A Collection of Articles on Higher Order Thinking Skills

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Think About It, Too

FOREWORD

REACH: Think About It was introduced at the Texas Education Agency's first Conference on Thinking in April 1988. It was written and demonstrated at the conference by staff members representing the Agency's standard curriculum. They did not treat thinking as a separate subject comparable to, but independent of, regular courses. Rather, they demonstrated imaginative strategies to teach higher level thinking in the process of teaching English, history, science, mathematics, and other regular subjects.

REACH: Think About It, Too, is being introduced at the Agency's second Conference on Thinking this October and, as with the first publication on higher level thinking, will be distributed to every superintendent and campus in the state. It differs from the first volume other than in name only. Here, we not only have articles written by Agency specialists from General Education, but also from Special and Vocational Education; Educational Technology; Special Programs; and educators in the field with broad experiences in higher level thinking. Their message is the same—yet not the same. They, too, did not treat thinking as a subject taught independently of other courses, but because the courses they discussed are not "regular"—suddenly the perspective changed. They said that higher level thinking is not the exclusive domain of the gifted, not just for grooming the intellectual elite, not just for students of a certain age, in a certain course. They said that thinking is what all students should do, in every subject, across all grades, in every school. Why? Because if students are not working on ideas, how meaningful is their work. . .to themselves and to their world?

Yes, teaching thinking is one of the current hot topics in education! But a fad? Merely buzz words? Unequivocably no! And for two reasons: First, as I discussed in the foreword to *REACH: Think About It,* reports from the NAEP show steady declines in the proportion of U.S. students demonstrating higher literacy skills such as analytical writing, problem solving, critical thinking, argument, analysis, synthesis, interpretation, and evaluation—and that is unacceptable. Furthermore, in Texas, low TEAMS scores in both high and low level skills have failed to budge—and that is unacceptable.

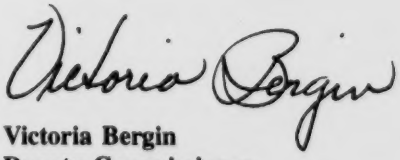
Secondly, we are in the midst of a sometimes perplexing period of transition from an industrial to an information society—and the entire educational institution must respond. We are becoming a nation in which things are made by machines and people work on ideas. A society that processes information calls for much higher levels of general literacy, more inquiry skills, and more widespread sophistication in

We are becoming a nation in which things are made by machines and people work on ideas. A society that processes information calls for much higher levels of general literacy, more inquiry skills, and more widespread sophistication in reasoning, analyzing, and interpreting information; more creativity, mental flexibility, and capacity to adapt to rapidly changing work demands and job structures.

reasoning, analyzing, and interpreting information; more creativity, mental flexibility, and capacity to adapt to rapidly changing work demands and job structures.

Think about it! This period of transition should be so enticing for educators! No longer will teachers train large numbers of students in the drill, practice, and rote kinds of learning that do not not lead to creativity or to any capacity to interpret, analyze, synthesize, or solve problems; the old industrial model of literacy simply will not serve students in the years ahead. It will be a transition that goes to the heart of the learning process. . . how schools are run, how teachers teach, what students do, and what the state requires. It will mean changes in instruction, better use of time, creating an atmosphere more conducive to learning, integrating technology more efficiently, and leading schools more effectively. It means placing responsibility where it belongs, so that the people closest to the problems have the responsibility to solve them. It means rewarding both competition and innovation. And it means we must get the experimentation we so desperately need. We mean to improve productivity so that more students stay in school and have much more of what they need to know.

As you pursue ways to put thinking in your schools, should you move too fast?. . . attempt to do too much?. . . expect too much?. . . take the short view?. . . neglect traditional course content?. . . or evaluation?. . . or the home environment?. . . capitulate to early failure? Of course not. But if your first efforts are disappointing, modify the program and push on! Mistakes are inevitable, and we are only just beginning.



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A CASE FOR HIGHER ORDER THINKING

Written by Gilbert Garcia Jr.
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In the 1970s, declining college entrance test scores reported by the Scholastic Aptitude Test (SAT), the California Achievement Test (CAT), and the National Assessment of Education Progress (NAEP) led to numerous documentaries, commission reports, and other research that cited disturbing evidence of graduating high school students who were unable to read, write, or calculate at an acceptable standard. *(Casey & Christie, Jenkins in Frahm & Covington)*

Disappointing student test scores raised questions about educational standards and brought about a demand for improved instruction. These demands fueled the accountability movement—and the measurement of student achievement based on test results or scores suddenly took on a new and important role. State legislatures, boards of education, and commissions responded by recommending minimum competency testing.

Since the movement began, over forty states have legislated actions requiring various uses for such testing. Airasian and Madaus note that testing has been used for the following policy-related purposes: "assessing educational equity; providing evidence on school and program effectiveness; allocating compensatory funds to school districts; evaluating teacher effectiveness; accrediting school districts; classifying students for remediation; and certifying successful completion of high school or a given grade of elementary school." In essence, testing has become the public monitor of educational standards, assisting in the identification of weaknesses in instruction and curriculum. *(Anrig)*

Today, researchers and educators continue to probe the effects of minimum competency tests. Some researchers, for example, have found that focusing on individual test items or objectives, rather than on total test scores, can reveal unique and statistically significant achievement differences that are useful in school improvement efforts. *(Hanson & Bailey; Harnish & Linn; Miller; Miller & Burstein)*

Why is it that students consistently master certain TEAMS objectives and not others? Clearly this data raises questions about instruction in some of the TEAMS simple objectives and all of the higher order objectives.

Disappointing student test scores raised questions about educational standards and brought about a demand for improved instruction.

This nationwide scrutiny of test scores revealed the decline of achievement in higher order thinking skills such as inference, analysis, interpretation, and problem solving. Note the findings of the NAEP:

- Of the four achievement groups, it is the top group, the highest achievers, who show declining scores in their overall reading performance at age seventeen.
- Two-thirds of the 17-year-olds are not doing any appreciable amount of writing in their classes.
- When asked to respond to literary works and explain their response in writing by analyzing the work, very few teenagers demonstrated strong analytic skills. In fact, only five to 10 percent of them did so. Another 35 to 50 percent showed they had an inkling of what to do; 25 to 40 percent tended to "retell" the work (summarize the plot or main idea); and 10 to 15 percent proved unable to respond.
- Seventeen-year-olds tended to move away from responses based upon inferential leaps (right or wrong) and more toward "egocentric" responses (in which they talk mainly about themselves instead of the work) and superficial evaluations.
- . . .performance on knowledge exercises remained the same or declined very slightly, but performance on problem-solving exercises declined dramatically: 5.9 percentage points at age 9; 3.4 percentage points at 13; and 4.0 points at age 17. In skills, 13-year-olds declined 2.0 percentage points and 17-year-olds declined 5.0 points.
- Post hoc analyses of the Scholastic Aptitude Test revealed that the greatest declines in that test also occurred among the items testing higher level skills.

Similar findings for ninth grade Texas students were evident in an analysis of performance results from the Texas Assessment of Basic Skills (TABS) Test, 1981-82 through 1984-85. Although my dissertation study, titled *Accountability and Assessment: A Policy Analysis of Minimum Competency Testing in Texas*, indicated that overall achievement scores were rising in the state, gains in higher order objectives were not increasing at the same rate.

In the study, data was obtained to show the number and percent of Texas school districts reporting mastery of each of the TABS mathematics and reading objectives by 70 percent of their ninth grade students. These objectives were then divided into two categories: (1) those mastered by 70 percent or more school districts, and (2) those mastered by less than 70 percent of school districts. Tables I and II list the findings:

TABLE I

TABS Objectives Mastered By At Least 70 Percent of Texas School Districts

Mathematics

Objectives in Rank Order	No. of Districts Reporting Mastery	Average Percent Reporting Mastery
1. Add/subtract whole numbers	955	97.8
11. Read, interpret charts/graphs	951	97.4
2. Multiply/divide whole numbers	945	96.8
7. Find total dollar amount/correct change	943	96.8
10. Determine distance/location on maps	928	95.1
5. Use decimals	846	86.7
8. Use measurement units	798	81.8

N = 976

Reading

8. Follow written directions	942	96.5
10. Use reference skills	916	93.8
11. Use maps, charts	868	88.9
2. Sequence events	774	79.3
3. Perceive cause-effect	773.5	79.3
6. Draw conclusions	742	76.0
4. Evaluate information	722	73.9

N = 976

TABLE II

TABS Objectives Mastered By Less Than 70 Percent of Texas School Districts

Mathematics

Objectives in Rank Order	No. of Districts Reporting Mastery	Average Percent Reporting Mastery
3. Solve problems	630	64.5
4. Use fractions/mixed numbers	403	41.3
9. Use ratio/proportion/percent	147	15.1
6. Solve personal finance problems	94	9.6

Reading

1. Identify main idea	626	64.1
7. Make generalizations	595.5	61.0
5. Distinguish fact/nonfact	580	59.4
9. Use parts of book	445.5	45.6

N = 976

The objectives listed in Table I show far higher mastery levels than those listed in Table II. Overall, most Texas school districts performed well. However, it was evident that eight of the 22 TABS objectives were not mastered consistently by the vast majority of Texas school districts. All eight objectives required higher order thinking.

The eight higher order TABS objectives noted in Table II were clustered to determine the number of school districts successfully mastering them and those most in need of remediation. Districts were divided into

...nationwide scrutiny of test scores revealed the decline of achievement in higher order thinking skills such as inference, analysis, interpretation, and problem solving.

two categories: (1) those with at least 70 percent mastery of each objective, and (2) those with less than 70 percent mastery. Table III lists the findings:

TABLE III
School District Mastery of Higher Order TABS Objectives

TABS Objectives	No. of Districts Reporting at Least 70% Mastery	No. of Districts Reporting Less Than 70% Mastery
Mathematics (3, 4, 6, & 9)	12 (1.23%)	155 (15.88%)
Reading (1, 5, 7, & 9)	66 (6.76%)	89 (9.12%)
Both Reading and Mathematics	8 (0.82%)	74 (7.58%)

N=976

Only eight districts reported that at least 70 percent or more of their ninth grade students consistently mastered all eight higher level TABS objectives. In alphabetical order, these districts were: Carroll, Highland Park, Humble, Irving, Midway, Plano, Randolph Field, Richardson.

These were discouraging results. First, TABS was a minimum competency assessment and, second, the objectives students had the most difficulty mastering were those most likely to be measured by college entrance examinations.

Are Texas students adequately prepared to master such objectives? A report on 1986 TEAMS scores, compiled by the Texas Education Agency's Division of Research and Information, may provide an answer. By clustering TEAMS objectives into groups of simple and higher order thinking skills, the following table notes the percent of students who mastered them in grade 3 through the Exit Level test.

TABLE IV
Mastery of Simple and Higher Order TEAMS Objectives

TEAMS Objectives	Mathematics	English Language Arts
Exit Level		
Simple	80.5	84.0
Higher Order	75.0	79.4

	Mathematics	Reading	Writing
Grade 9			
Simple	76.9	69.7	87.0
Higher Order	75.0	73.4	49.6
Grade 7			
Simple	80.2	81.6	80.6
Higher Order	78.5	72.3	50.8
Grade 5			
Simple	81.8	80.5	88.2
Higher Order	78.1	77.5	54.7
Grade 3			
Simple	90.3	84.4	92.1
Higher Order	91.4	81.9	53.2

*At the end of this article, Tables 5, 6 and 7 indicate the TEAMS objectives categorized as Simple (S) and Higher Order (*) for grades 3, 5, 7, 9 and Exit Level.

...it was evident that eight of the 22 TABS objectives were not mastered consistently by the vast majority of Texas school districts. All eight objectives required higher order thinking.

6

Of the TEAMS objectives testing higher level thinking skills, the following objectives were mastered by less than 70 percent of the Exit Level students:

Mathematics	English Language Arts
8. Multiple Operations	1. Main Idea
9. Proportion	17. Proofreading
11. Measurement Units	
17. Formulas	

Of the TEAMS objectives testing simple thinking skills, the following objectives were mastered by less than 70 percent of the Exit Level students:

Mathematics	English Language Arts
5. Fractions, mixed numbers	12. Punctuation
13. Geometric properties	13. Spelling

Why is it that students consistently master certain TEAMS objectives and not others? Clearly this data raises questions about instruction in some of the TEAMS simple objectives and all of the higher order objectives.

How do student achievement results affect individual campus performance? Are there campuses in the state where at least 70 percent of the students master not only the simple, but also the higher level TEAMS objectives? The data yielded these results:

Campuses Reporting At Least 70 Percent Mastery of all TEAMS Objectives

Elementary Campuses	299	
Secondary Campuses	20	
Total	319	N=Over 4,000

(Some campuses noted both elementary and secondary campuses because all grades were in one building.)

Should the educational community be concerned that only 319 out of 4,000 campuses have been able to master all of the TEAMS tests? It is, after all, a test of only minimum competencies. Has pervasive testing of lower level skills driven the time and motivation for teaching higher level skills out of the classroom? Have teachers done too much of the hard thinking for their students? Have students not been taught thinking skills or given opportunities to use them?

The TABS and TEAMS tests developed to assess the basic educational achievement of our students were never meant to hinder creativity in the classroom. Where I have observed campuses in which TEAMS results are impressive, the instructional lessons have focused on higher order thinking and TEAMS objectives have been incorporated within, but have not dominated, the lesson.

Should the educational community be concerned that only 319 out of 4,000 campuses have been able to master all of the TEAMS tests? It is, after all, a test of only minimum competencies.

Have students not been taught thinking skills or given opportunities to use them?

In an elementary classroom, for example, where students were reading a story, **main idea** (TEAMS) was addressed, **context clues** (TEAMS) were reviewed, and **specific details** (TEAMS) were identified, while setting, an essential element, was clearly the focus of the lesson. When the teacher offered the students an opportunity to alter the story's setting and analyze how the story would be affected by such change, the students became intensely involved. Clearly, thinking was an integral part of the lesson, and clearly the teacher expected students to use a wide array of thinking skills.

Numerous NAEP reports offer general strategies for helping teachers move beyond the basics to challenge students. Some of these strategies are:

Reading and Literature

- Stress inferential, as well as literal, comprehension skills.
- Cultivate interest in reading that will get students reading and keep them reading for longer periods of time.
- Make students write about what they read.
- Encourage students to make more than quick, superficial responses to their reading.
- Don't do all the hard thinking for the students. Let them do it. Some studies show that many writing teachers make the hard organizational and structural decisions for their students, leaving the students to fill in the blanks.

Writing

- Make students write in a variety of discourse modes such as persuasion or description and for a variety of audiences.
- Recognize that teaching grammar and correcting errors are only two aspects of writing and should not be overstressed.
- Provide pre-writing training and oral and written feedback on papers.
- Require students to rewrite papers after they have been fully diagnosed.

Mathematics and Science

- Take advantage of calculators as devices students can use to check their work and as handy teaching tools.
- Do not wait until students have mastered computation skills before going on to problem solving. Both can be taught at the same time.
- Give students the opportunity to interact with one another in exploratory projects.
- Take advantage of the good will students have toward both science and mathematics. (Studies show high student interest in these subjects.)

The NAEP also notes that all of these general teaching recommendations have been tied to highly specific teaching strategies in many education publications. However, the report adds a serious comment about the implementation of "challenge" in our classrooms: "Having established a list of 'how to's' for teachers, it is necessary to establish the conditions under which they are able or unable to carry them out. The most obvious constraints are their own knowledge, their time, their other assignments, their materials and their support systems. These are all factors over which principals, schools of education, teacher accrediting agencies and other administrators can exercise control." Creating challenging classroom environments will require support on many fronts.

Has pervasive testing of lower level skills driven the time and motivation for teaching higher level skills out of the classroom? Have teachers done too much of the hard thinking for their students?

Teachers at some of the 319 campuses that mastered all TEAMs objectives offer the following suggestions for teaching the thinking skills included in TEAMS and, in general, teaching students to think:

- TEAMS should be incorporated into the curriculum, but not dominate the curriculum.
- Activities requiring critical thinking should be developed for each TEAMS objective. When appropriate, timelines can be implemented to help pace instruction.
- Teachers should be trained in thinking processes and incorporate them in daily instruction.
- Staff development should be scheduled frequently in the broad area of thinking.
- Teachers should guide student responses and allow ample time for thinking before they respond.
- Students should be challenged in a positive and non-threatening manner. Ask students to think of many varied and unusual ideas, and to add to these ideas.

Readers of this publication will also find numerous references to current research in thinking and strategies for teaching thinking skills. *Bloom's Taxonomy of Educational Objectives*, illustrated on page 124 of *REACH: Think About It*, provides a framework for thinking, and examples of how to use the taxonomy appear in articles throughout Parts I and II of this volume on higher level thinking.

Conclusion

The analysis of individual TABS or TEAMS objectives, rather than the total test score, reveals differences in student achievement that are important to the teaching of higher order skills. The data presented in this article support the probability that many campuses or entire districts provide consistent, concentrated instruction in certain identified TEAMS objectives, while many objectives requiring higher level thinking are neglected.

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It is my hope that teachers and administrators will analyze their assessment results by objective for the past five years and determine if substantial gains have been made in higher order objectives. Effective student performance rests with the educators who direct daily instruction in the classroom and who have the greatest opportunities to affect student achievement.

TABLE V
Mathematics

TEAMS Objectives	Grade 3	Grade 5	Grade 7	Grade 9	Exit Level
1	S	S	S	S	S
2	S	S	S	S	S
3	S	S	S	S	S
4	S	S	*	*	S
5	S	S	*	*	S
6	S	*	S	*	S
7	S	*	S	*	S
8	*	*	S	S	*
9	*	S	*	S	*
10	S	*	S	*	*
11	S	S	S	*	*
12	N/A	N/A	N/A	N/A	*
13	N/A	N/A	N/A	N/A	S
14	N/A	N/A	N/A	N/A	S
15	N/A	N/A	N/A	N/A	*
16	N/A	N/A	N/A	N/A	*
17	N/A	N/A	N/A	N/A	*
18	N/A	N/A	N/A	N/A	S

* = Higher Order S = Simple

TABLE VI
Reading

TEAMS Objectives	Grade 3	Grade 5	Grade 7	Grade 9	Exit Level
1	*	*	*	*	*
2	S	*	*	S	*
3	*	S	S	S	S
4	S	S	S	S	S
5	S	*	*	*	S
6	S	*	*	*	*
7	S	*	*	*	*
8	*	S	S	S	S
9	S	S	S	*	S
10	N/A	N/A	S	S	*
11	N/A	N/A	N/A	S	S
12	N/A	N/A	N/A	N/A	S
13	N/A	N/A	N/A	N/A	S
14	N/A	N/A	N/A	N/A	S
15	N/A	N/A	N/A	N/A	S
16	N/A	N/A	N/A	N/A	S
17	N/A	N/A	N/A	N/A	*
18	N/A	N/A	N/A	N/A	*

* = Higher Order S = Simple

TABLE VII
Writing

	Grade 3	Grade 5	Grade 7	Grade 9	Exit Level
Objectives	S	S	S	S	S
Composition	*	*	*	*	*

* = Higher Order S = Simple

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EDUCATIONAL TECHNOLOGY

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13

DESIGNING A SUCCESSFUL PROBLEM SOLVING INSERVICE

Written by Thomas Boudrot
former Educational Technology Specialist
and currently Computer Instruction Consultant
Katy ISD

When you want to design a successful teacher inservice session in problem solving, where do you begin? The process itself is difficult enough, but when you add "problem solving" to the topic, problems seem to increase tenfold!

This article is designed to provide educators with a formula for developing and implementing problem-solving inservice sessions for commercially available software. After reading this article, teachers or administrators should be able to:

- Define the term "problem solving"
- Identify places within the curriculum where available problem-solving software can be used effectively
- List the steps in presenting a successful problem-solving workshop using software

What is Problem Solving?

To define problem solving, we must first consider the term "problem." A problem is a situation, quantitative or otherwise, that confronts an individual or group and requires resolution. It is a situation for which there appears to be no immediate solution.

Now let's apply the meaning of "problem" to the definition of the term, "problem solving." Problem solving is a process—a means by which an individual uses previously acquired knowledge, skills, and understanding to satisfy the demands of an unfamiliar situation. Problem solving is also an ability—the capacity to draw from past experiences to achieve a new or unique goal. There are many other aspects of problem solving not addressed here, such as creativity or fluency, for example. But, for the purposes of this paper, let's stick to the simple definition.

Problem solving is a process—a means by which an individual uses previously acquired knowledge, skills, and understanding to satisfy the demands of an unfamiliar situation. Problem solving is also an ability—the capacity to draw from past experiences to achieve a new or unique goal.

Using this definition, the goal of problem-solving instruction should be to provide students with a variety of experiences they can draw upon selectively to solve problems in daily life. In addition, it is im-

...the goal of problem-solving instruction should be to provide students with a variety of experiences they can draw upon selectively to solve problems in daily life.

portant that teachers help students apply these varied experiences in unique ways and in differing contexts. For example, after using software that reinforces concepts related to the conservation of volume, teachers could encourage the transfer of learning to new situations in which a variety of bottles and liquids are used to measure volume. Guided extensions are the key to successful transfer of skills and concepts to daily situations.

Where Does Problem Solving Fit?

With the increased emphasis on basic skills mastery and the added push for cultivating higher order thinking skills, teachers sometimes feel overwhelmed. The two types of skills, however, are not mutually exclusive. To comfortably integrate the two, we must identify areas of need within the curriculum and the availability of resources to teach these skills.

Any subject that focuses on process, rather than product, is a prime area for enhancement with problem-solving software. Consider the following:

- Locating reference books about the Pilgrims
- Converting pounds into grams
- Analyzing the long-term effects of the Civil War on American history
- Sorting blocks by size, color, and shape

You can see that process is everywhere! By extending learning past its rote and mechanical aspects, teachers can effectively integrate problem solving with basic skills instruction. This extension is the perfect vehicle for students to practice skills independently in a challenging and stimulating format.

To make basic and process-oriented skills match, however, you may have to compromise when it comes to software. Software should fit a situation rather than designing a situation to fit the software. A computer simulation about metric measurement may be right on target, but if it is simply used as a "Friday filler," the transfer of learning to real situations may be slight. Such activities have little impact upon student achievement.

So, how do you match software with your classroom activities? Take an inventory of all the software available in your school. Make a simple list that includes the following information:

Software Inventory

- Software title
- Subject area
- Major objective of package

- Grade level
- Special requirements (additional hardware or time constraints, for example)

Now note places in the curriculum guides and teacher's manuals where software packages might be used best. The process is a bit tedious but, when finished, the whole year is planned for computer use!

Getting Everyone Involved

The best way to learn about the software packages in your school is to organize an inservice session to get everyone involved. Prepare for the workshop a few days in advance by learning the major features of the software you will present. Allow approximately one hour of inservice time for each software package and ample time for instruction, guided practice, and limited independent use. Select and study no more than three packages for any session. Be certain to read the documentation and actually use the program with a computer! You don't have to know every feature of the package, but you must know how to use it effectively. Present each software package to the group by following these simple steps:

Any subject that focuses on process, rather than product, is a prime area for enhancement with problem-solving software.

Six Simple Steps to Successful Software Inservice

1 **Discuss the skill or concept being taught**
Tell the participants what the objective of the software is and attempt to relate the skill or concept to a practical situation. If, for example, the objective of the package is to classify objects by shape, relate this skill to sorting money or some other practical learning situation.

2 **Model the use of the software**
Show participants how to load the software into the computer and how to use the program successfully. If there are several levels of difficulty or special keystrokes used in the package, be certain to demonstrate them. Check to be certain that each participant understands how the software operates.

3 **Set goals**
Now allow participants to use the software. Tell them what they should do and approximately how long they will have to accomplish the task. For example: "You will have 20 minutes to complete levels one and four."

4 **Guide participants in using the software**
Once participants begin using the software, help them and ask questions where appropriate. Model the teaching behaviors expected in a classroom.

5 **Discuss strategies**
Once participants are successful, have them discuss the strategies they used. Encourage them to suggest different methods and procedures that would yield success. Remember, there is more than one way to solve most problems!

6 **Apply the skill or concept taught to other situations**
The job is not done unless participants can see ways to use their new skills in different situations. Have an alternative activity prepared that reinforces the skill just learned. Guide their application of the skill in new situations.

Putting It All Together

We often forget that the use of computers in the classroom does not become second nature to teachers over night. Time, effort, and patience play an important part in lessening anxious feelings about instructional computing. You can encourage computing by holding follow-up sessions in which teachers have opportunities to share ideas, discuss pitfalls, and recharge their interest. To the faint-of-heart, team teaching provides excellent support—a key element in computer program development.

Once educators understand and can apply a few software packages, integration into the classroom is more easily accomplished. In this way software fits the situation, not vice versa. With planning, teaching problem-solving skills can be greatly enhanced by the use of software. And, since software use is coordinated with the existing curriculum, impact upon student achievement is more assured.

By extending learning past its rote and mechanical aspects, teachers can effectively integrate problem solving with basic skills instruction.

Most problem-solving software packages focus on specific problem-solving skills, yet appear to have little in common with essential elements. If you look beneath the surface, however, you might be amazed at what you find.

SOFTWARE TO ENCOURAGE PROBLEM SOLVING

Written by Thomas Boudrot
former Educational Technology Specialist, TEA
and currently Computer Instruction Consultant, Katy ISD

Problem-solving software can be great—if you can figure out how to use it and where it integrates with your curriculum! Most problem-solving software packages focus on specific problem-solving skills, yet appear to have little in common with essential elements. If you look beneath the surface, however, you might be amazed at what you find.

Several companies and educational institutions have developed taxonomies that list the specific problem-solving skills reinforced by many popular software packages. One of the most well-known taxonomies is the CompuTHINK Cognitive Skills Model developed by the California State Department of Education. The major categories of skills are:

Enabling Skills
- Perceiving
- Conceiving
- Sequencing

Processes
- Analyzing
- Inferring

Operations
- Logical reasoning
- Creative thinking
- Problem solving

By correlating CompuTHINK skill categories to key words and learning objectives in the essential elements, software can be readily targeted for classroom use.

Let's look at one of the fourth grade mathematics essential elements:

> **Essential Element:**
> Concepts and skills associated with the understanding of numbers and the place-value system. Subelements include (a) compare and order, and (e) use fractions (models).

By correlating CompuTHINK skill categories to key words and learning objectives in the essential elements, software can be readily targeted for classroom use.

From the CompuTHINK taxonomy, the following problem-solving skills can be associated with these elements:

Problem-Solving Skill	Essential Element
Sequencing	• problem-solving skill • ordering or patterning • comparing or contrasting • grouping or labeling
Analyzing	• recognizing part or whole relationships

By previewing the software titles cross-referenced to CompuTHINK skills, you should discover a wealth of problem-solving material that extends student learning. On the next page there is a sample of the CompuTHINK taxonomy and a representative sampling of highly rated software from a variety of publishers. Armed with your curriculum guides and essential elements, you can begin to map your strategy for problem-solving software in no time!

The CompuTHINK model is reprinted with the permission of the Association for Supervision and Curriculum Development. (ASCD gives blanket permission to reprint for educational non-profit use. If written permission is required, contact: ASCD, 225 N. Washington Street, Alexandria, VA.)

NOTE: A companion article titled "Designing a Successful Problem Solving Inservice begins on page 15.

CompuTHINK Cognitive Skills Model

KEY

Skill Emphasis: ■ = Major • = Incidental

Rating: E = Excellent, VG = Very Good, G = Good

Cognitive Skills		COMPUTER SOFTWARE TITLES																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
		Bumble Games	Bumble Plot	Code Quest	Color Keys	Creature Creator	The Factory	First Things First/ Do This, Do That	Geography Search	Gertrude's Puzzles/ Gertrude's Secrets	Iggy's Gems	Memory Cards	M...e...ag L...abs	Mopiown Hotel	Mopiown Parade	Odd One Out	Pick the Part	The Pond	Regrouping	Rocky's Boots	Simon Says	Teasers by Tobbs	Teddy and Iggy	Teddy's Playground	Wm it There? Wm it Missing!	What's in a Frame?
*Rating		VG	VG	E	E	VG	E	VG	VG	E	E	VG	G	E	E	VG	G	E	G	E	G	E	E	E	G	G
Grade Level Range		K-3	2-12	4-12	4-12	K-6	4-12	K-6	4-12	K-6	K-6	4-5	3-6	3-12	K-6	K-6	K-6	2-12	4-6	4-9	K-9	4-12	K-3	K-6	K-6	K-6
ENABLING SKILLS	PERCEIVING																									
	Observing					■	•	■				•		•	■	■	■		■		■		■		■	■
	Recalling					■		■				■					■		■		■	■	■		■	■
	CONCEIVING																									
	Comparing/Contrasting					■	■			■	■			■	■	■								■		
	Grouping/Labeling									■					■	•			■					•		
	Categorizing/Classifying								•		•			■	■				■					•		
	SEQUENCING																									
	Ordering	■	■			■	■	■	•						■					•	•		■			
	Patterning				•	■			•						■			■		•	•	•		■		
	Prioritizing								•											•						
PROCESSES	ANALYZING																									
	Questioning	•	•	■					■					•		■				■		■				
	Discriminating Fact from Opinion																									
	Discriminating Relevant from Irrelevant			•					■																	
	Discriminating Reliable from Unreliable																									
	Recognizing Part to Whole Relationships			■	■	•	■		■				■		■		■		•	■				•	■	
	INFERRING																									
	Understanding Statements			■					■				•									■				
	Identifying Cause/Effect			•			•		■											■		•				
	Generalizing			■					■	•	•		•		■			•		•		•		■		
	Making Predictions			■			•		■				•		•					■		•				
	Identifying Assumptions			■					■													•				
	Identifying Point of View			•					■																	
OPERATIONS	LOGICAL REASONING																									
	Inductive	•	•	■			■		■	■	■		■	■	■	■		■		■		■		■		
	Deductive			■	■		■		■	■					•					■		■		■		
	CREATIVE THINKING																									
	Demonstrating Fluency			■					■											•						
	Demonstrating Flexibility			■					■											•						
	Demonstrating Originality			■					■											•						
	Elaborating			■					■											■						
	Creating New Ideas Spontaneously			■					■											•						
	PROBLEM SOLVING																									
	Making Judgments/Decisions			■	•		■		■					•	•	•				■						
	Defining a Problem			■					■											■		■				
	Determining the Desired Outcome			■			■		■											■		■				
	Searching for Possible Solutions			■					■						•					■		■				
	Selecting and Applying a Trial Solution			■		•	■		■	•					•			•		■		■				
	Evaluating Outcomes			■		•			■											■						
	Revising and Repeating Steps as needed			■			■		■						•			•		■						

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GENERAL EDUCATION

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PSYCHOMOTOR SKILLS: THE DISCOVERED ELEMENT OF THINKING

Written by Darla Thrasher
Physical Education Specialist

School programs are designed to help students develop a variety of diverse abilities necessary to function in adult society. These abilities have been categorized by Benjamin Bloom into three learning domains: cognitive, affective, and psychomotor. The domains are also translated into goals, the cognitive domain dealing with knowing and thinking abilities; the affective domain related to positive feelings, attitudes, and values; and the psychomotor domain related to motor skills.

In Bloom's taxonomy, cognitive higher order thinking skills are based on a sequential progression from the lower order thinking skills: knowledge, comprehension, and application; to the higher order skills: analysis, synthesis, and evaluation. Similarly, the essential elements of physical education also provide students with an opportunity to develop higher order thinking skills sequentially. These skills are learned and applied through movement.

In this article, motor skill development is defined by Laban and Lawrence as "the economy of effort a learner displays while perfecting a complex movement." *(Kirchner)* Achieving a fundamental motor or sports skill builds student self-image and increases motivation—basic building blocks in the learning process. As practice and skill attainment increase in complexity, illustrating both the spiraling nature of the physical education curriculum and the active involvement of students in their learning, students achieve a major goal of physical education: the development of the whole student mentally, physically, and emotionally.

Achieving a fundamental motor or sports skill builds student self-image and increases motivation—basic building blocks in the learning process. As practice and skill attainment increase in complexity, illustrating both the spiraling nature of the physical education curriculum and the active involvement of students in their learning, students achieve a major goal of physical education: the development of the whole student mentally, physically, and emotionally.

Using Bloom's Taxonomy to Learn Motor Skills

Thinking skills are an integral part of developing motor skills. The following section illustrates how students move from low to high levels of thinking in *Bloom's Taxonomy of Educational Objectives* when developing motor skills or performing fast-action sports.

Knowledge

Knowledge, the lowest level of thinking, is required when baseball players must remember the rules of the game and the concepts learned

Thinking skills are an integral part of developing motor skills.

in drill. For example, students catching batted balls learn to throw to bases in a particular sequence.

Comprehension
The next level of thinking, comprehension, is used when players understand the relationships and roles of various team members and how each interacts as part of a team. The shortstop demonstrates comprehension when a ground ball is caught and runners are on first and third base. The shortstop must predict the speed of the runners and estimate where to throw the ball.

Application
Increasing in complexity, application is the thinking level players use in unexpected situations. When runners are on first and third base, and the ball ricochets off the pitcher and dribbles into the area of the shortstop, the players must apply new concepts and principles to different situations. The shortstop cannot rely on advance assessment, although general guidelines such as "don't throw behind the runner" will be helpful. The shortstop must reassess the time and distance needed to secure the ball and the position and speed of the runners.

Analysis
Practicing the game of baseball requires continuous analysis. Students are required to break skills into parts to acquire the most efficient movement. The pitcher, for example, may discover that a ball thrown with sidearm motion causes a force that deflects it from its normal path. By using sidearm motion, the pitcher may throw a ball that causes right-handed batters to back away for fear of being hit by the ball. By breaking the principles of mechanics into even smaller parts, the student may discover that, in order for the pitch to curve, the ball must be thrown with a substantial amount of spin and in the direction of the spin.

Synthesis
When a pitcher creates a new technique for pitching that is unknown by other pitchers and is more efficient, the pitcher has moved into a higher level of thinking in the cognitive domain and higher level of development in the psychomotor domain. This placing of parts together into a new whole is called synthesis.

Evaluation
The highest level of thinking in Bloom's cognitive domain is called evaluation. Players use it when the instructor asks them to rank the principles of good sportsmanship in order of importance. Both cognitive and affective domains are combined at this level of thinking.

The following chart summarizes how baseball players are actively involved in all levels of thinking described in Bloom's taxonomy.

Bloom's Taxonomy and the Game of Baseball

EVALUATION	RANKING THE PRINCIPLES OF GOOD SPORTSMANSHIP IN ORDER OF IMPORTANCE
SYNTHESIS	CREATING NEW TECHNIQUES FOR PITCHING
ANALYSIS	BREAKING THE SKILL OF PITCHING INTO PARTS
APPLICATION	APPLYING CONCEPTS TO NEW SITUATIONS
COMPREHENSION	UNDERSTANDING RELATIONSHIPS AMONG TEAM PLAYERS
KNOWLEDGE	REMEMBERING THE RULES OF THE GAME

Movement Exploration and Problem Solving

Thinking skills are used daily in physical education. Some of the most effective practices for teaching students advanced thinking skills include movement exploration and problem-solving strategies. Both processes foster exploration, experimentation, and discovery—key elements in the learning process.

In physical education, the goal of movement exploration and problem solving is to increase student ability to predict what will happen if motor skills are performed in a certain way. By using a four-step process: (1) stating the problem, (2) allowing students to experiment with solutions, (3) applying the solutions to the problem, and (4) formulating conclusions to the problem, students should be able to identify more efficient means of moving.

In the primary grades, students learn ball handling skills.

EXAMPLE:

1—Stating the Problem

What is the best way to dribble a ball?

2—Experimenting with Solutions

When primary students are properly spaced throughout the gymnasium, the teacher asks:

- Can you bounce the ball very low? Bounce the ball very high?
- At a medium height?
- With hand relaxed?
- With the hand tensed?
- Move your arm a lot as you bounce it?

Practicing the game of baseball requires continuous analysis. Students are required to break skills into parts to acquire the most efficient movement.

- What happens when you slap at the ball as you bounce it?
- What happens when you push the ball as you bounce it?

3—Applying Solutions to the Problem

The teacher asks:

What is the best way to bounce the ball?

4—Formulating Conclusions to the Problem

By participating in these activities, students discover the best way to dribble the ball is to bounce it at medium level, forearm relaxed, and push with the fingertips.

Some of the most effective practices for teaching students advanced thinking skills include movement exploration and problem-solving strategies. Both processes foster exploration, experimentation, and discovery—key elements in the learning process.

Elementary students learn to examine more efficient goalkeeping strategies in soccer through movement exploration and problem solving.

EXAMPLE:

1—Stating the Problem

What body position helps you effectively block the soccer ball?

2—Experimenting with Solutions

A student is standing in front of the goal. As the teacher alternates throwing the ball to the right and left of the stu 'ent, the student predicts the direction the ball will move, experimenting with different strategies for blocking the ball.

The teacher asks:

- Can you adjust your body position to get to the ball faster?
- What happens when you try to block from an upright position?

3—Applying Solutions to the Problem

The teacher asks:

- Can you block the ball from a lower position?
- From the same position with the knees bent and the center of gravity low?

4—Formulating Conclusions

The student may discover that by lowering the center of gravity, ready position will be obtained more easily, and movement to the ball will become quicker.

In middle school, movement exploration and problem-solving methods can be used to refine volleyball skills.

EXAMPLE:

1—Stating the Problem

Can you improve the accuracy of your bump pass?

2—Experimenting with Solutions

The teacher explains and demonstrates the curled finger and clinched fist position of holding hands for the bump pass. The teacher asks:

- Can you return the ball I toss to you using the clinched fist position?
- Can you return the ball using the curled finger position?

3—Applying Solutions to the Problem

The teacher might have students analyze their tasks, asking:

Which technique provides a better rebounding surface from the forearm?

4—Formulating Conclusions

Students will discover that the clinched fist position provides an even rebound surface for the ball.

High school teachers use problem solving to teach students efficient body position as they practice tennis skills.

EXAMPLE:

1—Stating the Problem

- What is the most efficient method to align yourself for a forehand drive?
- What happens if you bend your knees and keep your weight on the balls of your feet as you return the tennis ball?

2—Experimenting with Solutions

The teacher throws a tennis ball to the right of the student and asks:

- Can you return the ball using a forehand drive?
- What happens if you bend your knees and keep your weight on the balls of your feet when returning the ball?

If experiencing difficulty returning the ball within the playing boundaries, the student may experiment with applying solutions to the following problems:

. . .the goal of movement exploration and problem solving is to increase student ability to predict what will happen if motor skills are performed in a certain way.

Reference List:

Bloom, B. 1983. *Taxonomy of Educational Objectives. Book I.* New York: Longman Inc.

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3—Applying Solutions to the Problem

- Which way should I turn my body to return a more accurate forehand drive?
- What happens if I transfer my weight toward the net when I hit the ball?

4—Formulating Conclusions

Students will discover that transferring weight toward the net, rather than the sideline, while executing the forehand drive will allow the ball to be returned more accurately.

Summary

The essential elements of physical education give students an opportunity to develop higher order skills while learning fundamental motor or sports skills. Students develop the capacity to solve problems in a natural environment for learning thinking skills. When using the four-step problem-solving process, they are able to analyze their motor skills and become more proficient in both motor and thinking skills.

TEACHING ADOLESCENTS ABOUT COMMUNICATING IN FAMILIES

Written by Carolyn Klein
Health Education Specialist

One way to improve health instruction is to teach thinking skills because they empower students to take responsibility for their own health as they mature.

Effective health education changes what students know about good health, how much they value healthy living, and whether they practice healthy habits. Connell, Turner, and Mason found that teachers are usually successful in imparting health information but have limited impact on health attitudes and practices. One way to improve health instruction is to teach thinking skills because they empower students to take responsibility for their own health as they mature. This article describes an application of a thinking skill called "proceduralizing" that fosters effective communication in families. Teachers can introduce it in a unit on family communication in a seventh grade health education class and later apply it to other health topics.

The Value of Communication Procedures

Proceduralizing is breaking a complex process into manageable parts and learning to use the process until it becomes automatic. Applying this skill to communication is not a new idea; its usefulness is well-established in its most formal application, parliamentary procedure, and in other situations such as mountain climbing and cardiopulmonary resuscitation. Mountain climbers, for example, communicate frequently with one another about their security. One climber asks another to anchor the rope and listens for a response. Both climbers know that neither will move until a response is made. Each uses the procedure automatically, confident that the other will use it. Neither would consider abandoning it because both are free to enjoy a safe climb when the procedure is used. Clearly, communication procedures help mountain climbers, but how can they help families?

Often, adolescents and their parents misunderstand each other because they react to one another without thinking. However, by using procedures that foster thinking before speaking, families build expectations that effective communication will take place and that concerns will be understood. When these helpful procedures become automatic,

. . . by using procedures that foster thinking before speaking, families build expectations that effective communication will take place and that concerns will be understood.

families are freed from unhealthy communication habits that cause conflict.

Teaching Adolescents To Think Before They Speak

Involving Parents

Teachers who intend to teach about family communication should share information about the upcoming unit with parents through newsletters or parent-teacher meetings. Involving parents is important because students are more successful when parents help them. A teacher's newsletter can help parents by providing background about the thinking skill called proceduralizing, by reducing their anxiety, and by encouraging them to ask their children about it.

Introducing the Lesson

Teaching students about communication procedures begins by showing familiar examples of everyday communication patterns. Figure 1 is an example of a conversation between an adolescent and his father. Teachers can display it on a chart for students to read.

Ineffective Family Communication

Duane:	"Kirk stormed into the bedroom again without knocking. That kid has no respect for my privacy."
Duane's father:	"Well, it's his room, too. You know the house is too small for each of you to have your own room."
Duane:	"You always defend him. Nobody cares about my feelings."
Duane's father:	"At least we know where he is and what he's doing. You just lock yourself in your room for hours."
Duane:	"I'm not a baby, you know. I deserve some time to myself."
Duane's father:	"I make the rules in this family. Now leave your brother alone. That's the end of this discussion."

FIGURE 1

Analyzing the Example

The teacher reviews the conversation between Duane and his father and helps them understand why this is an example of ineffective communication. It resembles the real-life experiences of most adolescents. Students can easily see that Duane acted as follows: (1) He heard what his father said, (2) he interpreted his father's words, (3) he reacted emotionally, and (4) he responded defensively. They can also see that Duane's father reacted the same way. Students will have no problem identifying emotional words and phrases in the conversation. Circling them on the chart highlights their prominence. This activity shows

that the conversation was merely an emotional exchange that involved no cognition; that is, no thinking.

Displaying a Model Procedure for Effective Communication

After a brief discussion, the teacher explains that thinking before speaking could change the outcome of the conversation between Duane and his father. Figure 2 shows a procedure for thinking before speaking by answering six questions. The procedure is part of an instructional activity in the *Teenage Health Teaching Modules*, a comprehensive school health education curriculum.

Effective Family Communication:
The Six-Question Procedure

Question 1: What do I say the problem is?

Answer: I want a place where I can relax and be alone, but my dad says I have to share a room with my brother.

Question 2: What does my father say the problem is?

Answer: He says the house is too small for me to have my own room.

Question 3: What do my words mean?

Answer: I don't like the way my brother bursts into the room anytime he likes. I think I'm old enough to have some privacy.

Question 4: What do my father's words mean?

Answer: My dad doesn't understand why I would want to spend time alone unless I have a problem. He worries that I will withdraw from the family.

Question 5: How do I feel about this?

Answer: I feel untrusted and that I am being treated like a child.

Question 6: How does my father feel about this?

Answer: My dad feels afraid that I won't ask for help when I am troubled about something and he is worried.

FIGURE 2

Comparing the Results

The value of thinking before speaking is that it gives students a systematic way to prepare for cooperative communication. Health education research emphasizes the importance of communication in families; however, students will not be interested in using it unless

Health education research emphasizes the importance of communication in families; however, students will not be interested in using it unless it helps them achieve results they consider important.

it helps them achieve results they consider important. Some desirable results of thinking before speaking are:

- Fewer arguments with parents
- Fewer, clearer rules
- More chances for their parents to hear and understand their concerns
- More chances to ask for and get privileges

Reminding students of these results persuades them to listen actively, to participate in instructional activities, and to practice listening before speaking.

Reinforcing the Skill by Role Playing

Providing many opportunities to role play about noncrisis situations prepares students to transfer the skill to sensitive situations in their private lives. It is neither necessary nor advisable to use examples that infringe upon family privacy. Guidance helps students participate without embarrassment and benefit from practice.

Some teachers begin role playing by providing written examples of situations and initial statements made by two hypothetical people such as two friends, an adolescent and younger sibling, or an adolescent and parent. Students can form small discussion groups and practice the six-question procedure. This process can be repeated several times until students are able to mentally picture themselves using it in real situations. Repetition leads to automaticity; that is, habitual use of a beneficial skill.

Teacher guidance reduces the likelihood that students will practice harmful skills such as making verbal attacks on others. A communication procedure is beneficial only when it replaces chaos with order, suspicion with trust, and defensiveness with cooperation. The six-question procedure shows promise for achieving these results.

Extending the Skill

Once students find that communication procedures are helpful, they are ready to learn a higher level skill, designing their own procedures to prepare for other kinds of communication. They can start with the six-question procedure or other helpful models, or they can start from scratch. The idea is to design procedures that lead to good results. For example, when students receive an invitation to a party, they might realize that their parents always ask who else will be there, whether other parents will be there, and when the party will end. Getting this information before asking for permission to go to the party would be an important step to add to the planning procedure. They can use the procedure every time they receive an invitation instead of entering a discussion unprepared.

Because students retain thinking skills by practicing them, it is important to apply them to other health topics and encourage their use in other courses.

Students can design their own procedures by following these steps:

- Identify the sequence of steps.
- Write the steps down.
- Read over the procedure and mentally picture yourself using it.
- Occasionally review and revise the procedure to make it better.
- When the procedure becomes automatic, use it without referring to the description you wrote.

This process of designing useful procedures appears in *Tactics for Thinking*, a thinking skills curriculum. One way to conclude a unit on family communication is to help students design their own procedure and practice the way they will talk with their parents.

The Importance of Practice

Because students retain thinking skills by practicing them, it is important to apply them to other health topics and encourage their use in other courses. Thinking before speaking is useful in classes like social studies or physical education in which group interaction is common. Student organizations such as student councils can benefit from using communication procedures, and school staff members can apply them to assertive discipline programs. The more applications students observe, the better they will be able to use them.

Conclusion

A health education class is an excellent setting for teaching a thinking skill to use in emotionally charged situations. Students who learn to think before speaking soon realize that thinking does not diminish emotions; it only channels emotional expression toward healthful results. Careful instruction, guided practice, and reinforcement inside and outside the classroom prepare students to use the skill until it becomes a habit.

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THINKING SKILLS AND DRIVER EDUCATION: A NATURAL PARTNERSHIP

Written by Glenn Peavy
Director of Safety and Driver Education

Educational leaders and experts agree that, along with the trend to increase the academic rigor of education, it is critical for teachers to teach the thinking skills needed to be successful students and productive adults. To ensure that thinking skills are taught, instructional leaders must plan and administer a program that prepares and guides teachers.

Just as in other courses, thinking skills are needed for driver education students to successfully complete the course. Even more importantly, many of the higher level thinking skills are needed to perform the more critical tasks tasks of safe driving. These are decision making, problem solving, and values formation.

An examination of the statistics for traffic crashes shows that few accidents result from limited knowledge or physical skills. The majority of the accidents are caused by faulty decision making or attitudes. The three leading causes of motor vehicle crashes and deaths are: (1) driving under the influence of alcohol or other drugs, (2) driving too fast for existing conditions, and (3) failing to use seat belts and other safety restraints. The values people hold determine their attitudes about a variety of concepts in their lives.

Just as in other courses, thinking skills are needed for driver education students to successfully complete the course. Even more importantly, many of the higher level thinking skills are needed to perform the more critical tasks tasks of safe driving. These are decision making, problem solving, and values formation.

The Objectives of Driver Education

Driver education has two categories of objectives:

- Instructional objectives
- Traffic safety objectives

Because driver education students are highly motivated to pass the course, teachers have a distinct advantage in reaching the instructional objectives. By the time students enroll in driver education, they have already acquired many of the thinking skills needed to be successful students. All driver education teachers need do is teach the techniques that continue to build on those skills. However, they must also be alert to students who either have not learned the basic skills or are not using them. Using the principles of effective teaching practices, driver education teachers can, with most students, successfully achieve instructional objectives.

To achieve the traffic safety goal of driver education, teachers must do much more than simply impart knowledge or identify appropriate attitudes. Young people. . .will drive with the attitudes and values that they formulate, not the "canned" statements presented from the lectern. Students must learn the techniques to examine values, evaluate evidence, and make decisions.

The ultimate objective of driver education—traffic safety—is to reduce deaths and property damage that result from motor vehicle crashes. Nationally, more than 45,000 lives and $47 billion are lost each year from traffic mishaps. In fact, in America more people between the ages of one and 40 die from traffic accidents than from any disease or other single cause. There is no question that a national problem of this magnitude requires the attention of national and state governments and the public schools. The problem, however, requires a multifaceted solution, of which driver education is only a small but vital part.

The challenge to driver educators is to produce drivers who, despite their age-group tendencies and lack of experience, will mature into responsible drivers. Developing the skills needed to drive is not the challenge—bears have been taught to ride motorcycles and monkeys to drive small cars. Guiding students to adopt the attitudes that will result in their voluntary compliance with traffic laws, refraining from driving under the influence of alcohol and other drugs, using safety restraints, maintaining safe speeds, and becoming citizens who will support traffic safety measures is the ultimate goal.

To achieve the traffic safety goal of driver education, teachers must do much more than simply impart knowledge or identify appropriate attitudes. Young people learning to drive will drive with the attitudes and values that they formulate, not the "canned" statements presented from the lectern. Students must learn the techniques to examine values, evaluate evidence, and make decisions. Guiding students to form appropriate attitudes demands that teachers be knowledgeable about thinking skills and know how to teach students to use them. In addition, successful driving requires drivers to be constantly alert, reading the driving environment, and making appropriate decisions. Driving tasks involve many thinking skills including maintaining attention and recognizing traffic patterns.

Thinking Skills

Robert Marzano and Daisy Arredondo, in their TACTICS program, have identified 22 skills and processes for thinking, divided into three categories. Skills discussed in this article are highlighted.

Learning To Learn Skills

- *Attention control*
- Deep processing
- Memory frameworks
- Power frameworks
- Goal setting
- Responsibility

Content Thinking Skills

- Concept attainment
- Concept development
- Pattern recognition
- *Macro-pattern recognition*
- *Synthesizing*
- *Proceduralizing*

Reasoning Skills

- Analogical reasoning
- Extrapolation
- Evaluation of evidence
- *Examination of values*
- *Decision making*
- Nonlinguistic patterns
- *Elaboration*
- Everyday problem solving
- Academic problem solving
- Invention

The authors advise that not all 22 skills and processes presented in TACTICS are easily applied in every grade and subject. For their program, they have adopted the following three assumptions:

- Teaching thinking skills should be overt, teacher-directed, and part of regular classroom instruction.
- To a large extent, successful students have already acquired essential cognitive skills outside of school.
- Teaching thinking skills within formal education will necessitate a change or restructuring of curriculum, instruction, and assessment techniques.

By studying the *TACTICS For Thinking Teacher's Manual* and other publications on the subject, and by attending training sessions, driver education teachers can easily identify which thinking skills they consider necessary to achieve both the educational and traffic safety objectives of driver education. Examples of how to teach some of these higher level thinking skills are discussed in the section that follows.

Teaching Thinking Skills and Driving

Maintaining Proper Attention

Maintaining proper attention is a prerequisite in both the classroom and driving phase of driver education. To help students maintain proper attention, teachers should lead the class in a discussion of the importance of controlling their attention. Teachers might ask: "Why is attention control important?" If the students are unable to answer, teachers should give examples, asking: "When you are having a test and traffic outside the classroom distracts you, what are the conse-

The proceduralizing process...is designed to teach students to perform a task in an orderly and safe manner.

Macro patterning requires students to organize large blocks of information into patterns. One technique for teaching accident avoidance in driver education is to study case histories of motor vehicle accidents, then ask students to determine the causes and suggest techniques for avoiding similar accidents.

quences if you cannot maintain your attention?" or "Why is it important to maintain good attention when driving on a local expressway during peak hours?" With this guidance, students will be able to relate examples of instances when attention is needed in learning or driving. Once the importance of maintaining attention is established, the teacher can move on to teaching techniques for maintaining proper attention.

Proceduralizing

Proceduralizing is commonly used in teaching driving. When, for example, students make a "predriving check" before putting the car in motion from the side of the road, they learn this set of procedures:

- Check left outside mirror
- Activate left turn signal
- Apply left foot to the brake pedal
- Place gear selector in "drive"
- Check inside mirror
- Check blind spot on left
- Accelerate slowly and enter inside traffic lane

The proceduralizing process, in this case, is designed to teach students to perform a task in an orderly and safe manner. The pattern is further strengthened by the series of events being arranged to flow from left to right. Teachers should point out the value of using proceduralizing in learning a task and challenge students to identify other ways it can be used in learning and thinking.

Macro Patterning

Macro patterning requires students to organize large blocks of information into patterns. One technique for teaching accident avoidance in driver education is to study case histories of motor vehicle accidents, then ask students to determine the causes and suggest techniques for avoiding similar accidents. Teachers could also show a film discussing issues related to traffic safety, such as laws limiting alcoholic beverages to persons age 21 or older. After the film, teachers can help students develop macro patterns of the concepts presented and possibly hold a debate to explore the issues.

Synthesizing

Synthesizing helps students consider large amounts of information and through practice, reorganize the information in an understandable, yet briefer form. Through synthesizing, drivers learn to successfully manage the visual stimuli they receive from a multitude of traffic patterns. By dividing the class into small groups to cull only the most important facts from a film of driving scenes, students learn the skill of synthesizing. Developing outlines or graphs of the information are also helpful exercises.

Examining Values

In driver education classes, students are taught to identify their feelings about concepts or issues, identify and measure the validity of their underlying assumptions, and establish standards under which they would be willing to change their evaluation of the issue. This thinking skill is critical to teaching driver education; since driving performance is often based on attitudes or values, it is vital that students reach valid conclusions about issues such as the use of alcohol, drugs, seatbelts, and speed control. The areas related to the responsibilities of driving are also ripe for teaching examination of values.

Decision Making

Driving a car requires constant decision making before and during driving. Before driving, drivers must make decisions based on fuel, routes, travel time, physical condition of the car, and weather. All of these factors will influence the driver while driving. Teachers can teach students the decision-making process by asking them to determine the safety of driving conditions shown in films.

Elaborating

Elaborating is the process of inferring information that is not stated. Experienced drivers constantly practice the process. The ability to read traffic patterns for clues that the driver translates into expectations of other drivers' actions is a form of elaboration. For example, drivers learn that traffic congestion causes irritability that leads to sudden unexpected maneuvers that require others to take evasive action. No signs are posted that say "Watch out for irritable drivers and sudden maneuvers," but experienced drivers have learned to extract that information through elaboration. Because beginning drivers have had few driving experiences, teachers must create images of experiences. The process of elaborating is fundamental to almost all types of thinking and is also used in developing values by examining causes and consequences.

Summary

The examples of how to teach vital thinking skills to driver education students all have one common feature: They involve students as active partners in learning. Teaching these strategies requires teacher training and supportive curriculum materials. Since driver education now is a full semester credit course in Texas schools, teachers have an opportunity to present the essential elements more comprehensively using tactics that guide students to higher levels of thinking. Leading students to recognize that driving is a cerebral, rather than physical, task is a prerequisite to driver education—a vital contribution to improving traffic safety in America.

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THINKING ABOUT ACTING

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Educational theatre can produce a stimulating environment for learning—an environment in which dynamic relationships between students and subject matter foster interpretive, analytic, creative, synthetic, and critical thinking. The educational value of theatre derives from an inherent need of people to transcend the limitations of personal identity and participate in other forms of existence. Theatre becomes a window through which to observe and explore life. The playwright selects some particular aspect of human behavior, and the director, actors, and technicians interpret the work for an audience's response. The dramatic medium liberates the imagination, creating a dual consciousness in which the real and fictional worlds are juxtaposed in the mind.

When watching a play in the theatre or a film or a television show, people willingly enter an imaginary world but always remain aware they are watching an illusion of reality. Much of the enjoyment that arises from drama comes from the effort to discover its underlying principles, to see through the illusion to the actuality beyond. An audience works hard to make sense of the scattered bits of dramatic information it receives. From the moment the play begins, assumptions are made and expectations develop as audience members speculate about the world unfolding before them. They supplement the hypothetical situations they are witnessing with their own knowledge and experience of the real world, measuring the fictional against the actual.

Education, in general, is the process of helping individuals find essential meanings in life. These meanings accrue as one lives through and draws inferences from actual and symbolic experiences both in life and in role.

Education, in general, is the process of helping individuals find essential meanings in life. These meanings accrue as one lives through and draws inferences from actual and symbolic experiences both in life and in role. By responding to other people's cues and receiving responses in return, young children begin to establish their own identity. They learn to take risks as they explore new possibilities through conversation and role play. They learn about life through the stories of others and through their own storying in dramatic play. As skills grow, they expand their perceptions and enhance their ability to express personal thoughts and feelings.

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Outside the classroom, children are typically active, self-directed learners. Educational theatre fosters these same qualities in school situations, helping students develop techniques and skills for exploring a wider range of interests. In creative dramatizations of stories and improvisational explorations of scripts, students actively engage in situations that make sense to them in terms of their past experiences and their present levels of understanding. To foster high-level thinking, the teacher should structure dramatic experiences to expand students' current spheres of reference and increase their understanding by providing new experiences and fresh perspectives from which to reflect on those experiences.

Although students are engaged in make-believe situations, the real world continues to exist; the learning that occurs stems from the interaction of symbolic and actual meanings. What is important is not the literal enactment of a plot but the process of exploring the meanings of the story—the themes, concepts, and issues. Time can be altered and ideas juxtaposed. Students can pause to examine a particular moment, linger on an image, or move forward, backward, and even sideways in an attempt to make meaning happen.

The significance of the dramatic experience depends not on the experience itself but on the reflection that occurs about the experience, especially within the context of the drama. As individuals role play, things happen and words are spoken that affect and modify the actions and behaviors of others. The introduction of concepts and issues challenges students to consider the implications of their decisions and to take responsibility for the consequences of their actions. To take on a role is to detach oneself from what is implicitly known and understood. It invites analysis, evaluation, and modification of concepts already held.

The Multiple Minds of the Actor

Acting appears simple because everyone does it more or less instinctively from early childhood throughout life. It is only when one begins to study the craft and art of acting that its true complexity is revealed.

Acting requires thinking, a truly complex process for any individual. Actors, however, exist not just as themselves but as three personalities. Each must think simultaneously as:

- A person in the real world
- An actor creating a fictional character
- A character interacting with other characters

Actors are human beings who eat, sleep, think, and feel. But if an audience becomes too aware of them as real people, the illusionary nature of the theatre is affected.

Outside the classroom, children are typically active, self-directed learners. Educational theatre fosters these same qualities in school situations, helping students develop techniques and skills for exploring a wider range of interests.

The actors' task is to bring figures of fantasy to life. This involves a double transformation: as two actors are transformed into the fictional characters of Hamlet and Ophelia, the Shakespearian characters are transformed into the living being of the actors. Such transformations occur as the actors combine their personal experiences with the experiences contained in the script. The resulting characterizations are unique. One actor's Ophelia will always be different from the Ophelia played by another actor.

A performance presents the dramatic interplay of fictional characters. If characters do not act and react with each other, the theatrical illusion dissolves. This occasionally happens when actors, for any number of reasons, fail to maintain their third person and revert to behaving as actors or as people in the real world.

The Acting Process

Acting can be seen as a journey of exploration and discovery. The first part is the exploration process in which actors seek the characters that live both in the script and in themselves. The second stage is the transformation that occurs when the actors discover and become the characters. The third part is the performance when the actors present the characters they have created to an audience.

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The Quest for the Character

During the rehearsal period, actors enter the world of the play to discover the characters who live there. This is primarily a time of psychological development. Eventually the actors must learn their lines and refine their movements, but initially they absorb the life that resides within the playwright's text. Actors take into themselves the mannerisms, disposition, and texture of the mind of the characters they are playing. This is a double discovery, for the actors must also find aspects of the characters that exist within themselves. The rehearsal period is the time when—through study, observation, emotional recall, contemplation, experimentation, and selection—appropriate qualities of their own beings are synthesized with the unique demands of the characters they are to play.

The rehearsal period is also when actors establish contact with each other. Dynamic interaction can only be achieved if the actors are continually conscious of and responsive to each other's words, movements, and thoughts.

Finally, during rehearsals the actors come to understand the play's structure: the dramatic action of each scene, the inherent emotional content, and how one event builds to the next. This enables the actors to keep the performance on course no matter what distractions occur in any given performance.

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Acting appears simple because everyone does it more or less instinctively from early childhood throughout life. It is only when one begins to study the craft and art of acting that its true complexity is revealed.

The Transformation into the Character

The crucial point in the rehearsal process is the moment when actors become possessed by their characters. This transformation does not happen to all actors at the same time. Unfortunately, some actors never reach this stage, which explains unsatisfying performances.

As they search for the characters, actors become receptive to unconscious impulses that exist within themselves: repressed feelings, hidden desires to play out roles or situations, flashes of inspiration. The transformation, or possession, occurs when the actors tap into some aspect of their own psyche that enables them to understand and identify with the characters.

The Presentation of the Character

Possession does not mean loss of consciousness or control. Rather, actors enter a heightened state of double consciousness in which they are, and are not, themselves. The journey of discovery is completed when the actors present their characters to an audience.

Actors are experts in self-perception, or metacognition. They are able to stand off from themselves and observe their actions and feelings. They perceive their characters as they exist both within themselves and in the world of the play. Their consciousness must be able to shift from one to the other if they are to successfully interact with the other actors, cope with unexpected occurrences, and adjust to responses from the audience. The following charts identify the various thinking skills inherent in the acting process and illustrate their application.

Auditions

Thinking Skills	Sample Applications
Attending	Students will: • Enhance self-concept by assessing personal attributes and abilities • Envision successful realization of goal • Consider diagnosed limitations and set goals for personal development
Concentration	• Focus on director's instructions • Listen and interact with other actors in improvisations
Memory	• Memorize dialogue for prepared readings • Recall sensations and emotions for characterization
Intuition	• React spontaneously during improvisations and cold readings
Emotional Identification	• Apply recalled sensory and emotional experiences in improvisations and readings
Inference	• Presume a character's objectives and motivation
Imaging	• Visualize a character in improvisations and readings • Respond to an imagined environment in improvisations
Fluency and Application	• Warm up the body and voice • Apply physical and vocal techniques in improvisations and readings

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Script and Character Analysis

Thinking Skills	Sample Applications
Attending	Students will: • Determine a character's goals and objectives
Concentration	• Focus on task of play and character analysis
Conceptualization & Analysis	• Analyze the elements of the script including plot, character, theme, dialogue, music, and spectacle • Analyze the dramatic action including exposition, inciting incident, complications, climax, and resolution • Prepare a character's biographical profile including physical, mental, emotional, and social characteristics • Analyze the script in terms of the Aristotelian unities of time, place, and action • Analyze the sociological context of the script including political, social, educational, ethnic, economic, religious, historical, and aesthetic aspects
Comparison	• Compare language (word choice, grammatical structure) of different characters • Compare text and subtext to determine character's objectives and motivations
Pattern Recognition	• Analyze the dramatic structure of the play • Analyze dialogue for syntax, sentence structure, and word choice in reference to period style and character's social class, ethnicity, age • Analyze the interrelationship of the play's theme and contemporary sociological issues
Extrapolation	• Equate the qualities of music, objects, animals, and colors with characters in the play • Compare contemporary social mores with those in the historical period of the play
Inference	• Explore the subtext of the play to determine character objectives and motivation • Create additional background information about the characters
Imaging	• Consider images evoked by the play's title, names and descriptions of characters and settings • Visualize the characters and settings
Critical Analysis	• Evaluate the movement and vocal choices based on script requirements and research
Valuing	• Evaluate the merit of artistic compromises made in the process of realizing a character • Examine the attitudes and values of different characters

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Rehearsal and Performance

Thinking Skills	Sample Applications
Attending	Students will: • Adjust personal goals to coincide with goals set forth in the rehearsal schedule • In the course of performing, work to achieve the character's goals and objectives
Concentration	• Maintain physical and vocal control while acting • Listen and respond to the words and actions of other actors
Observation	• Observe physical and vocal characteristics of people
Memory	• Recall sensations and emotions for characterization • Remember lines and blocking
Conceptualization	• Apply elements of movement and blocking and elements of vocal production • Consider and employ theories and styles of acting
Intuition	• Consider instinctive responses when improvising movement and dialogue
Emotional Identification	• Apply recalled sensory and emotional experiences in improvisations and scene work • Use body language and vocal techniques to physicalize and vocalize emotional states
Analysis	• Analyze the physical and behavioral traits of characters • Analyze the script for character objectives and clues to motivation • Analyze variable expressive qualities of the body and voice
Comparison	• Compare characters' movement and vocal qualities • Compare interpretations of the same role by different actors
Pattern Recognition	• Explore movement and voice patterns • Employ space and movement in blocking to illustrate and motivate conflict between characters
Extrapolation	• Apply observations of people, animals, and objects to the development of physical and vocal traits of a character • Explore the qualities of music, objects, and colors and equate them with specific characters • Analyze the behavior of a character in the context of a play and portray the character in different circumstances
Inference	• Assume the emotional state of a person based on their movements and speech • Engage in improvisations based on limited given circumstances
Imaging	• Visualize a character • Respond to an imagined environment • Employ symbolic movements and gestures to communicate subtext
Fluency and Application	• Develop flexibility, strength, control, coordination, and endurance for expressive use of the body and voice

Rehearsal and Performance

Collaboration	• Engage in reciprocal acting to establish relationships between and among characters • Work with other members of the production company during rehearsals and performances
Problem Solving	• Choose appropriate movements and vocal qualities for a character • Discover blocking and interaction that establishes character relationships and motivates dramatic action
Invention	• Realize a character

Summative Evaluation

Thinking Skills	Sample Applications
Conceptualization	Students will: • Establish performance criteria
Emotional Identification	• Compare emotional reactions with intellectual responses
Analysis	• Examine reasons for personal responses to various elements of a production
Comparison	• Compare a professional play review to one's personal response • Compare the relative effectiveness of two different productions of the same play • Compare presentations of the same dramatic source in different media: theatre, film, television
Extrapolation	• Juxtapose professional play reviews with personal reviews
Critical Analysis	• Evaluate play productions according to established criteria • Evolve personal criteria based on knowledge and experience
Valuing	• Reflect on the worth of the theatrical event as an effort to interpret, intensify, and ennoble human experience

The Actors' Craft

Acting requires commitment, arduous training, and an historical perspective of theatre. Characterization demands a wide scope of general knowledge, attention to detail, and that final mysterious synthesis within the imagination that brings it all to life. What is poured into the creation of roles springs from all that actors have thought and felt, read, and known up to that moment. To accomplish this complex

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Acting can be seen as a journey of exploration and discovery.

process, they must have first developed the essential elements of their medium: mastery of the body and voice, understanding and control of the emotions, heightened powers of observation, a highly developed imagination capable of being attuned with the characters being played, and an intelligence able to perceive the world of the play contained in the playwright's script.

Theatre Arts Programs Designed to Teach and Encourage Thinking

Creative Drama: Prekindergarten-Grade 6

The basis of the theatre arts program in the elementary school is creative drama, an improvisational, nonexhibitional, process-centered form of theatre in which leaders guide participants to imagine, enact, and reflect upon human experiences.

Creative drama is a structured form of play-acting that capitalizes on drama as a natural developmental process. The teacher bases improvised dramatizations, which can relate to any and all subject areas, on stories and concepts from literature, history, current events, and on students' imaginations. Literary source material may include some play scripts but is primarily comprised of children's stories and poems.

The typical creative drama lesson begins with warmup and motivational activities. Acting as a guide, the teacher tells the students a story or presents an idea. The class discusses the dramatic action, who will play what roles, and how space will be used. After planning, the students act out the narrative either in segments or from beginning to end. Participants evaluate each improvisation or playing. They may replay some scenes one or more times with improvements and extensions. A calming activity closes the session.

The teacher frequently uses the technique of side-coaching, suggesting actions and ideas the students might consider incorporating while they are enacting a scene. Sometimes side-coaching is directed to all the students, and sometimes comments are quietly shared with individuals. It is often desirable for the teacher to play a character role in the dramatizations. Generally the character is an authority figure or one who can legitimately control and guide the actions of the students.

Creative drama is the primary process teachers use to teach all the elementary theatre arts essential elements. Students develop their sensory and emotional awareness and expressively use their voices and bodies as they communicate verbally and nonverbally in dramatizations. After viewing a theatrical event, students review their experiences as audience members and enhance their discussion by recreating favorite scenes or acting out alternative courses of action that characters might have taken.

The rehearsal period is the time when—through study, observation, emotional recall, contemplation, experimentation, and selection—appropriate qualities of their own beings are synthesized with the unique demands of the characters they are to play.

Creative Drama: Grades 7-12
Creative drama continues as an integral part of the secondary school theatre curriculum, being more commonly referred to as improvisation. Theatre games and improvised scenes provide warmup and motivational activities, as well as enabling students to explore dramatic subtext as they work to develop more complex characterizations. Teachers frequently use improvisation as an idea-stimulating process to help teach playwriting. Students may use improvisation to create and refine original formal theatre pieces. Advanced students may also act in live improvised theatre productions, spontaneously dramatizing characters and situations suggested by the audience.

Formal Theatre: Prekindergarten-Grade 6
The primary purpose of the elementary theatre arts curriculum is to nourish the receptive faculties and expressive abilities of the individual—not to promote formal theatre wherein students are taught to perform for an audience. Components of formal theatre provide focus and structure for creative drama activities, but the entertainment of an audience is not the goal.

There may be times when elementary students have a collective desire to share a particular creative drama project with others outside the classroom. Such plays differ substantially from traditional productions in that students initially improvise dialogue and action rather than memorize lines and rehearse following a written script. The focus remains on the natural exciting process of creative drama as a means of developing the body, mind, and imagination.

Formal Theatre: Grades 7-12
The nature of performance and formal theatre production serves as the basis of the secondary theatre arts curriculum. Grades 7 and 8 introduce basic acting techniques for the purpose of interpreting dramatic literature. Students prepare acting scenes and small-scale productions specifically for presentation to audiences. In high school, they study advanced acting techniques for portraying more complex characterizations and explore technical theatre in depth. Subsequent full-scale productions presented in a variety of styles and modes provide for the exploration, development, and synthesis of all elements of theatre.

Acting in a play places specific real-life and artistic demands upon young people. They must face the challenge of auditions; work with scripted materials to analyze characters and motivate lines and blocking; use research, imagination, and improvisation to solve countless theatrical problems; acquire the discipline demanded by rehearsal and production schedules; collaborate with other artists; and cooperate with individuals and groups in both school and community. Although not every secondary school student will take part in productions, all students can actively participate as perceptive members of the audience. The following chart identifies and compares thinking skills inherent in creative drama and formal acting.

Actors are experts in self-perception, or metacognition. . . .They perceive their characters as they exist both within themselves and in the world of the play. Their consciousness must be able to shift from one to the other if they are to successfully interact with the other actors, cope with unexpected occurrences, and adjust to responses from the audience.

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Thinking Skills Used in the Theatre Arts Program

	Thinking Skills																					
	Perceive								Comprehend				Imagine		Create				Evaluate	
Creative Drama	Attending	Concentration	Observation	Memory	Conceptualization	Intuition	Emotional Identification		Analysis	Comparison	Pattern Recognition	Extrapolation	Inference	Imaging	Fluency and Application	Collaboration	Problem Solving	Invention	Critical Analysis	Valuing
• Warmup																				
• Motivation																				
• Presentation of idea or story																				
• Preparation for playing																				
• Discussion of dramatic action																				
• Assignment of characters																				
• Determination of how space will be utilized																				
• Playing out of dramatization																				
• Evaluation																				
• Preparation for replaying																				
• Improvements																				
• Reassignment of characters																				
• Extensions																				
• Replaying																				
• Evaluation																				
• Closing																				
Formal Acting																				
• Auditions																				
• Script and Character Analysis																				
• Rehearsals																				
• Performance																				
• Summative Evaluation																				

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Strategies for Nurturing Thinking in Actors

Relevant Material

Theatre is concerned with the examination of human issues in specific social contexts. To teach students to make decisions and cope with the complexities of relationships in our modern ever-changing society, teachers should choose relevant dramatic situations for creative dramatizations and formal theatre production that do not merely reflect and reinforce existing perceptions but challenge students to engage in independent thinking. Students can thus gain fresh insight about themselves and their world.

Learning Styles

Teachers and administrators must recognize that there are different learning styles at work in the classroom. Some learners use their voices and ears as the primary mode for learning, some are attuned to visual images, others need to touch and be physically involved in what they are studying, and other learners function in more than one modality.

Effective teachers will provide their students with opportunities to hear, see, and do each time a new concept is presented and reinforced. By working initially through the students' strongest learning modality, students can then be encouraged to develop strategies to transfer material they may encounter through their weaker modalities. Assignments should include auditory, visual, and kinesthetic tasks. When it is time for summary evaluation, students can be given a choice in the way they take the test, or the teacher may vary the method of testing from week to week. Opportunities can thus be provided for the extraverted student to act while thinking and for the introverted student to think before acting.

Process-Centered Directing: Grades 7-12

A major impulse for experimentation and change in today's theatre has been a rediscovered sense of play and widespread popularity of theatre games. Approaching theatre as play can create a joyous atmosphere for both rehearsal and performance where the process becomes as important as the product.

The modern teaching director is, or should be, concerned with discovering the nature of theatre as well as with staging productions. Moving beyond conventional practices, directing then becomes the search for an effective process that can produce the envisioned results. While methods will vary depending on the script being staged and the individuals involved, process-centered directing includes the following general characteristics:

- The approach is open, flexible, and committed to continuing experimentation.
- Problem solving and discovery rely on total group collaboration.

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Characterization demands a wide scope of general knowledge, attention to detail, and that final mysterious synthesis within the imagination that brings it all to life. What is poured into the creation of roles springs from all that actors have thought and felt, read, and known up to that moment.

- Direction is nonauthoritarian and free of preconceived attitudes, prejudices, judgments, and patterns.
- Stage movement blocking often emerges as the intuitive, innovative solution to the theatrical needs of the moment.
- Direction serves as an evocative, resourceful, stimulating, provoking catalyst.
- Emphasis is placed on finding deeper insights and perspectives to enhance the final theatre communication.

Contemporary directing—as well as all aspects of educational theatre—should and can be an eclectic, ever-evolving, thought-provoking process.

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SPECIAL EDUCATION

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LEARNING TO LEARN: EXECUTIVE CONTROL STRATEGIES FOR HANDICAPPED STUDENTS

Written by Ann Smisko
Director of Programs, Special Education

A primary goal of schooling is to teach learning strategies and tactics so that students continue to learn, not just during their school careers, but throughout their lives. Learning how to learn is often more difficult for handicapped students, and others who have trouble with academic material, than learning the material itself. Students who have trouble with their courses may benefit from learning how to control their learning, a function called "executive control," by Derry and Murphy.

Executive control focuses on the deliberate, conscious aspects of strategic thinking. The term "metacognition" is also used to refer to a learner's knowledge of his or her own learning processes and the attempt to control these processes. Executive control, or metacognition, includes three aspects:

- **Identifying Learning Goals**

  The learner decides:

  - What must be learned
  - How much must be learned
  - When it must be learned

- **Deploying Goal-Directed Tactics**

  The learner uses:

  - Knowledge of learning tactics like mnemonics
  - Knowledge of different learning situations
  - Information about when each tactic can be helpful
  - Rules about how to apply various learning tactics

Learning how to learn is often more difficult for handicapped students...than learning the material itself.

For students to control metacognitive processes, teachers must deliberately teach the strategies of control.

- **Monitoring Goals and Tactics**

  The learner evaluates:

  - Whether knowledge has been acquired
  - The appropriateness of the learning tactics used

For students to control metacognitive processes, teachers must deliberately teach the strategies of control. Some aspects of this teaching process include:

- Leading students to understand the need for learning the skill
- Introducing the skill, modeling the skill, having students recognize the skill
- Practicing the skill and refining it until it can be used in other situations
- Planning specific situations in which to use the skill
- Using the skill in real world contexts
- Reviewing the skill occasionally

By mastering and correctly using these strategies, students acquire classroom survival skills for organization, study, test taking, and problem solving. Specific metacognitive strategies important for handicapped students in the common areas of memory, reading, and affective support follow.

Metacognitive Strategies for Handicapped Students

Memory

Students are taught common memorization techniques including rehearsal, mnemonics, elaboration, and organizational strategies.

- **Rehearsal**

  The learner repeats the sequence to be memorized. It is best to begin with a short segment, gradually adding more to the sequence as the beginning items are learned. Rehearsing at frequent intervals is important to success; early rehearsals should be immediate, and additional trials should be scheduled within a few hours so that the sequence is not forgotten.

- **Mnemonics**

  There are many types of mnemonic strategies, such as making a "word" by using the first letter of a series of words as a reminder of each word. For example: REACH stands for "Realistic Educational Achievement Can Happen." Similarly, a sentence could be developed in which each word represents an idea in a group of ideas to be remembered about a topic. For example: "Every good boy does fine" helps students remember the music notes in the treble clef. Another strategy is to deliberately exaggerate one aspect of

a name, face, or idea to associate with the name or idea to be recalled. For example: "The principal is my pal" is commonly used to help students remember the spelling of the word "principal," as opposed to "principle." What is important is using the same strategy to develop mnemonics for all learning situations so that students do not become confused.

- **Organization**

  Organizational skills help students keep up with assignments, prepare for tests, and focus their thoughts in class. The most common organizational strategy is teaching students to record and keep track of their assignments in a notebook. A variation of that strategy is a "tickler file," used to remind students to study or prepare certain materials several days in advance of due dates. Outlining assignments and class notes is another important organizational strategy, not only to break long projects into logical components, but also to help students highlight important facts or concepts and organize them for study. Once these techniques are part of their repertoire, they must continue to use the skills in ever-increasing learning situations.

Reading

- **Set Goals**

  An intelligent reading strategy begins with setting goals for a reading selection. If, for example, a student needs to memorize or synthesize information, a different strategy is needed than if the student only needs to follow directions, such as steps outlined in a laboratory manual. Before beginning a reading assignment, students should be taught to verbalize, either quietly to themselves or in writing, the goal they wish to achieve.

  Once students have an appropriate reading goal in mind, they can select appropriate reading tactics. Direct instruction can help students draw information from written material and structure it for efficient learning and use. Reading strategies, depending on the reading goal, include:

  - skimming—finding essential information without reading every word
  - summarizing—developing a concise statement of the main points
  - outlining—highlighting the overall structure of the passage

- **Use Existing Knowledge**

  Students need to be taught to use what they already know. One technique is to use clues in the text to make hypotheses about what is likely to happen next in the passage. Students can then evaluate these hypotheses as new evidence comes along. Teachers can either read the passages to the students, stopping at points in the text to question students about their hypotheses, or have students answer questions inserted in the text as they progress with their reading selection.

By mastering and correctly using these strategies, students acquire classroom survival skills for organization, study, test taking, and problem solving.

Helping students gain knowledge to extend their understanding of a given topic is a fundamental teaching activity. Students need an organizational framework in which they can "hang" new information. New material becomes incorporated into this framework by meshing with their relevant existing knowledge. David Ausubel calls the introduction of concepts relevant to a new topic "advance organizers."

The most common introduction to new topics is the historical overview, in which students learn about events leading up to a topic to be studied. Research by Ausubel indicates, however, that students are better able to learn and retain material that is introduced with "substantive," rather than "historical," advance organizers. Substantive organizers anchor the students' existing relevant concepts to new concepts within their organizational frameworks. Piaget called the processes of integrating new information "assimilation" and "accommodation."

To build on students' existing knowledge, the introduction of new material should focus on similarities and differences between old and new material, the advantages or disadvantages of new concepts when compared to old, and the reasons for developing new concepts. Giving students the names of chemical elements and the dates they were discovered is an example of an historical advance organizer. Dividing chemical elements into categories of solids, liquids, and gases is an example of a substantive organizer. In teaching parts of the lesson cycle, an historical advance organizer would provide background data on why and how the cycle was developed, while a substantive advance organizer would focus on how students learn and relate the lesson cycle to those learning needs. Substantive organizers are better than knowing the "who," "what," "when," and "where" of a new topic when students need to link their knowledge to a new topic.

- **Monitor Comprehension**

Many poor readers do not recognize when they misunderstand what they've read—a sense of puzzlement is the metacognitive experience that alerts able readers and prompts them to review a passage or otherwise seek greater understanding. However, handicapped students can be taught to recognize this sense of puzzlement and then use it as a cue to review for understanding. Any action they take should be as unobtrusive as possible, the least disruptive action being to review the previous passage or to continue reading to see if the passage becomes clear. Only as a last resort should students be taught to look up a word in the dictionary or seek expert help, as this technique disrupts the flow of reading and takes more time.

Some of the reading strategies outlined in the section in this article on setting goals can also help students monitor their understanding

Students need to be taught to use what they already know. One technique is to use clues in the text to make hypotheses about what is likely to happen next in the passage.

of reading material. Taking notes as they read is a time-honored method of monitoring understanding. Self-directed questioning and summarizing can accomplish the same results in less time if students learn to stop after each section of text and review the passage to check their understanding. In regular classes, handicapped students should frequently be reminded to use all of these reading techniques, but particularly those that monitor comprehension.

Affective Support Training

Students need to feel in control of their learning to achieve academically. Studies of "learned helplessness" have shown that a sense of powerlessness to influence outcomes or to succeed has a negative effect upon learning. (Seligman) Setting personal learning goals and monitoring and rewarding one's own progress have also been shown to increase grades.

Negative thoughts and images have a detrimental impact on a handicapped student's ability to learn, but learners who use positive self-talk have positive results. Rehearsing positive thoughts such as "I'm pretty good at this," or "Let me try to think of some other ideas," can help students learn more easily. Although intention to learn is not a prerequisite to learning, a positive attitude toward the task and one's ability to perform the task can help. For handicapped students with a history of failure in new tasks at school, teachers can help students list the positive attributes and experiences they bring to the task to initiate positive self-talk. For example: "Our class is good at...," or "You have good ideas about...."

In addition to positive self-talk, handicapped students can be taught how to apply problem-solving strategies to problems they encounter in studying, test taking, assignments or interpersonal relationships, among others. These skills are especially important for a smooth transition to less restrictive classroom placement. Experience in effective problem solving builds self-esteem and motivates students to actively take responsibility for their learning and to risk more challenging goals. Charles Meisgeier says handicapped students can learn to solve problems by following a logical sequence of skills. In the process, students learn to:

- Define the problem
- Identify feelings about the problem
- Take responsibility for the problem
- Formulate possible solutions and consequences
- Choose a solution
- Plan to carry out the solution
- Try the plan

Helping students gain knowledge to extend their understanding of a given topic is a fundamental teaching activity. Students need an organizational framework in which they can "hang" new information. New material becomes incorporated into this framework by meshing with their relevant existing knowledge.

- Evaluate the result
- Correct the plan

Application

Test-taking skills are an important application of executive control and can contribute to the success of handicapped students. Test taking involves all of the organizational, reading, and memory skills discussed earlier. The focus of learning skills is to help students use time well, choose correct responses, perform accurately, and check their work. They should be taught both general test-taking skills and adaptations for specific types of test questions like true-false, matching, essay, and multiple choice.

Some schools have developed study skill courses that may help students develop executive control. Because long-term, frequent practice is important in acquiring metacognitive skills, study skill courses for handicapped students stress the application of these skills to the students' current study problems in regular academic courses. Research findings show that these courses, when isolated from daily coursework, may have dual shortcomings: (1) The short length of these courses is inadequate for long-term, varied practice, and (2) they tend to be taught in the absence of meaningful content. To be effective, study skill courses should first provide direct instruction in learning tactics independent of any particular subject and, second, they should link these strategies to relevant, real-world situations found in specific subjects.

Summary

Although executive control skills initially may be taught independent of academic content, handicapped students must be taught to use them in academic classes. Gradual development of these skills over an extended period of time will ensure that they become second nature and more useful to them. If taught to the point of being automatic, executive control skills will enable students to become successful lifetime learners.

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THE USE OF GRAPHIC ORGANIZERS WITH HEARING-IMPAIRED STUDENTS

Written by Sha Cowan
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Students who are hearing impaired often experience delays in developing language, because they do not have access to a full range of auditory stimuli. The nature of a hearing loss tends to cause language and communication problems, particularly in understanding situations, conversations, and written materials. To compensate for hearing and comprehension problems, teachers of these students have learned to use visual and graphic organizers as part of instruction. The visual representation of information is a technique that aids comprehension, as well as other levels of cognition that comprise Bloom's taxonomy.

This article will present an overview of several graphic organizers that help hearing-impaired students see how concepts and ideas are related. In Bloom's language, these thinking skills are called comprehension and synthesis. Students may prefer one type of organizational pattern or add others to represent a concept, generalization, sequence, process or cause, or similarity and dissimilarity.

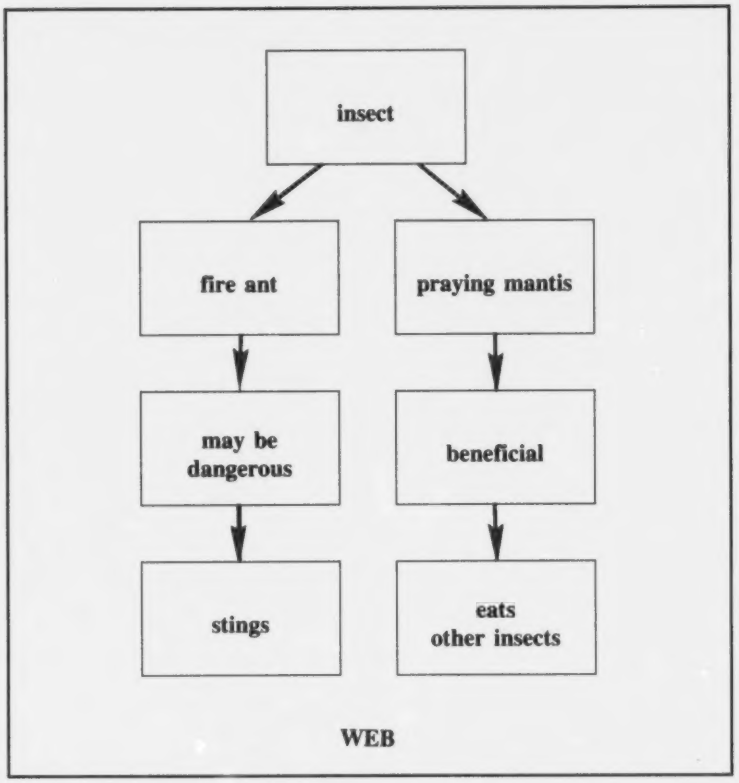
Types of Graphic Organizers

Webs

One of the most frequently used patterns is the web or spider, which helps students synthesize or summarize information. *(Marzano & Arredondo)* In a web, students use circles and lines to display and connect information in a way that represents relationships among ideas. The following illustration of a web displays information about two types of insects:

The nature of a hearing loss tends to cause language and communication problems, particularly in understanding situations, conversations, and written materials.

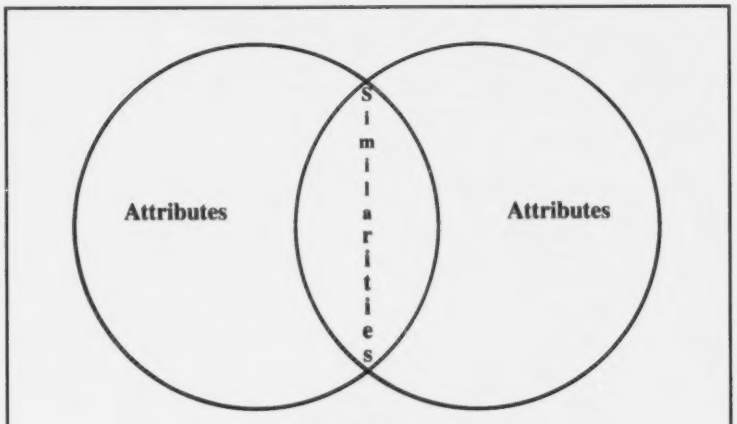
The visual representation of information is a technique that aids comprehension, as well as other levels of cognition...



WEB

Venn Diagrams

Another type of pattern, the Venn Diagram, or contrast overlay structure, allows students to graphically organize attributes between two sources or concepts and overlap the similarities between the two.



VENN DIAGRAM

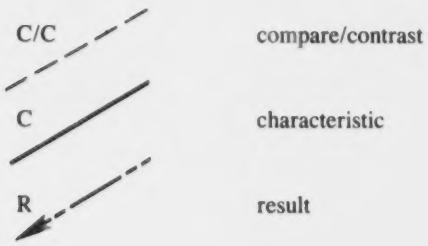
Three additional types of graphic organizers—networks, semantic maps, and story maps—help hearing-impaired students understand, organize, summarize, and evaluate information.

Networks

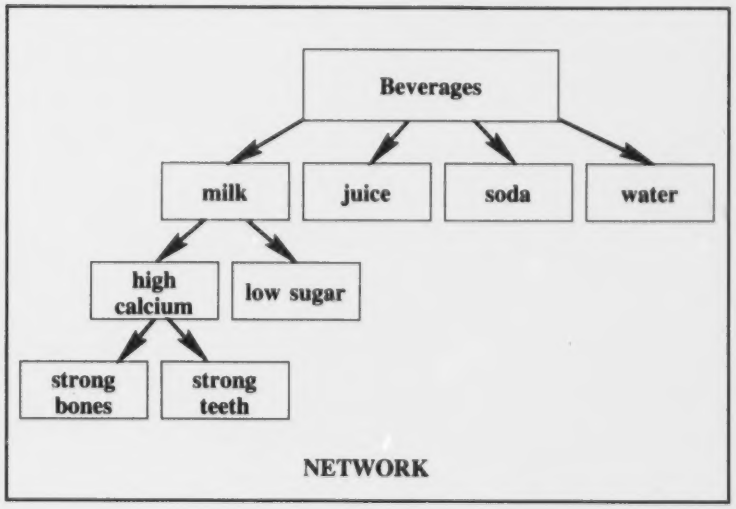
Networking is a technique originally designed for postsecondary hearing-impaired students at the National Technical Institute for the Deaf in Rochester, New York, to help students learn to identify and understand the relationships among concepts. The technique has also improved study skills and reading comprehension and, for teachers, knowledge of test construction. A network is diagramed visually so that ideas are placed in circles; arrows show direction or relationship. The basic ideas or relationships are coded as follows:

characteristic	C
compare/contrast	C/C
definition	D
example	E
sequence	S
relationship	R

Some systems of networking may also use specially coded lines to show relationships:



This example shows a basic network about beverages.



NETWORK

Networking is a tool that helps students better internalize information.

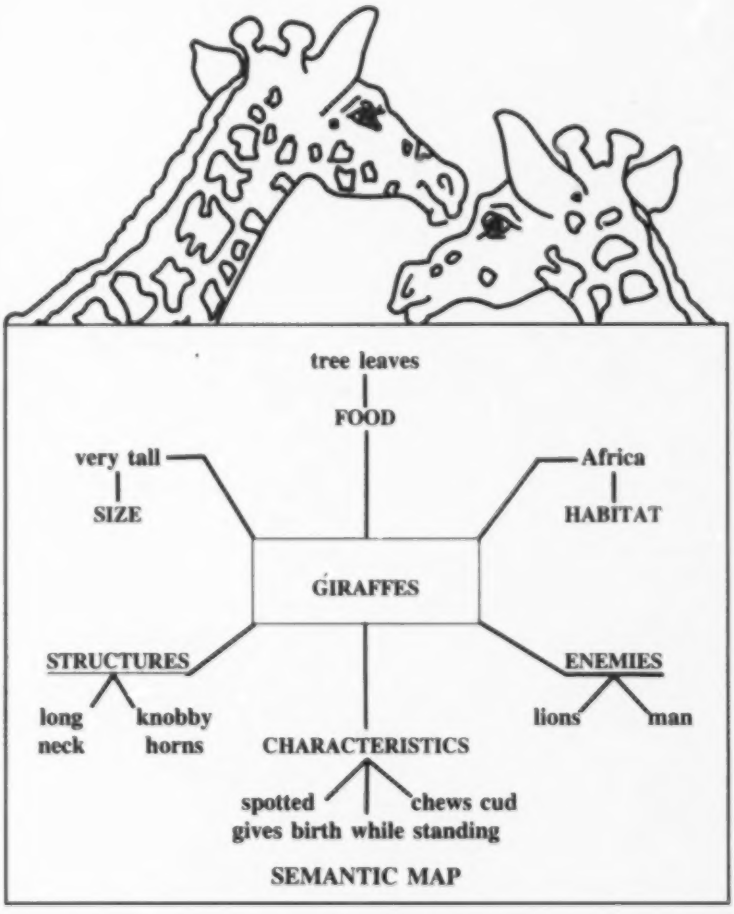
The procedure for mapping a topic gives students an opportunity to learn the meanings and uses of new words, give new meanings to old words, and see specific relationships among concepts.

Networking is a tool that helps students better internalize information. They can easily learn the pattern and become more active participants in classroom activities, discussions, and problem solving.

Semantic Maps

Semantic mapping groups categories of information graphically. Students are required to relate new words to their own experiences and knowledge. *(Johnson & Pearson)* The procedure for mapping a topic gives students an opportunity to learn the meanings and uses of new words, give new meanings to old words, and see specific relationships among concepts. Semantic mapping can also be used in writing and pre- and post-reading activities. The pattern is equally beneficial to teachers and students; it helps students learn to organize their thoughts and information and provides teachers with information about what students know.

The following is an example of a semantic map completed by students prior to reading about giraffes:



As the story is read, or afterwards, students can add new words and categories to their own copies of the map. Class discussion is the final phase of this procedure.

Story Maps

Story maps are similar to semantic maps but are specifically used to organize a story visually, showing relationships of selected story members or events. They can be used for both pre- and post-reading activities. For example, students can use a given story map to predict events and outcomes in a story before reading it. After reading a story, they may be asked to reproduce the story map from memory and compare this with the original. Students can also use a story map to write about the events and characters of a story read previously. Various patterns and structures of story maps may show main idea features, comparison and contrast, sequential detail, or cause-effect. A cause-effect map is shown below:

CAUSE-EFFECT MAP

The clock or ring pattern is a type of sequential detail map consisting of a series of separate, but related, adventures that begin and end at the same place. On the clock or ring, an X at twelve o'clock marks the beginning or ending of the story. The first and last parts of the story must be identical in setting, but changes in the characters may have occurred. An example of a clock pattern, using *There's no Such Thing as a Dragon,* by Jack Kent, follows:

> *Story synopsis:* A dragon comes to live with Billie Bixbee, his mother, and father. Whenever Billie mentions the dragon to his mother, she replies, "There's no such thing as a dragon." The dragon begins to grow and eventually fills the entire house. Once Billie's parents acknowledge his presence, he begins to shrink to his original size.

The pattern is equally beneficial to teachers and students; it helps students learn to organize their thoughts and information and provides teachers with information about what students know.

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SEQUENTIAL MAP

Summary

Graphic organizers are a helpful teaching technique for students who have hearing, language, or communication problems. They provide a visual pattern to integrate concepts, characters, and events. In addition, these visual techniques are appropriate as advance organizers for reading, writing, and questioning, and as an aid to review and recall. And finally, the information gained from using webs, Venn diagrams, networks, semantic maps, and story maps is equally as beneficial to teachers as it is to students.

SPECIAL PROGRAMS

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DEVELOPING THE THINKING OF COMPENSATORY STUDENTS

Written by Anna Pedroza
Educational Program Director of Special Programs

Higher level thinking comprises the mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts. The elements of higher level thinking encompass creative, analytical, critical, and evaluative skills. The struggle to teach basic skills to compensatory students often excludes higher level skills and unnecessarily diminishes their importance. An examination of specific TEAMS objectives that focus on higher level thinking confirms this fact. In mathematics, for example, lower performance scores occur on objectives related to word problems and probabilities; in reading, on sequencing and drawing conclusions. While research indicates that developing higher level thinking skills also develops basic skills, compensatory students must be carefully introduced to higher level skills and given special consideration.

The Need to Prepare Students

By learning higher level thinking skills, compensatory students are empowered with strong basic skills, coupled with life skills that include decision making and problem solving. These students, however, must be introduced to thinking skills in a developmental, process-oriented manner. Their academic program should include sufficient time to develop an understanding of these skills and provide them with ample guidance to apply them in safe, meaningful contexts. Such a preparatory period gradually introduces students to the varying sophisticated levels and complexities of the skills incorporated in higher level thinking abilities.

Why is a preparatory period necessary for compensatory students to master higher level thinking skills? The answer is that often the background of these students does not provide opportunities for interaction with persons who model the processes of these skills. According to researcher Stanley Pogrow, at-risk students "lack experience in reflecting on ideas and constructing meanings and relationships." The result is limited development and application of these skills in their experiences, either at home or at school.

'What is honored in a country. . .will be cultivated there.'

Plato

The struggle to teach basic skills to compensatory students often excludes higher level skills and unnecessarily diminishes their importance.

Learning involves an element of risk regardless of subject matter. As educator Edward De Avila states: "Repeated failure or difficulty in school lowers interest in academic subject matter, as well as expectation for future success." Thus, self-confidence is essential to risk-taking, which in turn is a cornerstone for developing higher level thinking skills. Self-confidence also is an important consideration in the critical preparatory period when thinking skills are introduced to compensatory students. Students should not be caught in a situation where they are required to learn difficult content by applying culturally different thinking processes.

Conditions for Successful Programs

What conditions are required for compensatory students to best benefit from a program of thinking skills integrated into the curriculum? In addition to establishing an extended preparatory period, the following elements should be in place:

- A developmental approach to teaching higher level thinking skills to compensate students for limited exposure to these skills
- A district-wide support system that includes teachers, administrators, and the community
- An environment that values thinking skills and encourages creativity, divergent thought, and intellectual risk-taking in the classroom
- The development of the ability to manipulate language with sophistication to enhance basic and thinking skills
- The nurturing of student self-confidence by providing intellectual challenges in contexts they can understand.

Classroom Climate and Teacher Expectations

Teacher behavior and expectations play a major role in establishing the pace and climate that will support and incorporate thinking with basic skills. A mentally safe atmosphere provides security for students to think and express their thoughts without fear of rejection and reprimand for being wrong or different. Such a climate is receptive to original, divergent, and independent thinking. Such a climate provides compensatory students with additional time, encouragement, reinforcement, and challenge to risk high level thinking. Teachers who promote a supportive classroom climate demonstrate the following behaviors:

- Model an attitude of inquiry by demonstrating curiosity and interest
- Are receptive to a variety of opinions, judgments and methods
- Provide ample wait time for students to think through a response and its soundness
- Become familiar with a scope and sequence of thinking skills such as those of Rath, Bloom, or Gagne

- Encourage and expect high-level thinking from compensatory students
- Integrate higher level thinking strategies and activities in daily lesson plans
- Recognize higher level thinking as a quality that can be drawn out by setting proper conditions in the classroom.

The following chart suggests areas in which teachers can create a classroom climate conducive to high level thinking:

Classroom Climate	
Lower Level Thinking	**Higher Level Thinking**
Resources	
Classroom as main center of learning	Free access to library, adults
Questions	
Closed, emphasis on specifics	Open-ended
Classroom Organization	
Teacher domination, close organization	Student independence, self-management
Production	
Emphasis on perfection	Emphasis on ideas of merit
Interests	
Application to fewer interests	Support of wide unique interests
Communication	
Structured by teacher	Pupil-centered, free use of debate, controversy

From Ruth Martinson and Jean Wiener in *The Improvement of Teaching Procedures with Gifted Elementary and Secondary School Students.*

By learning higher level thinking skills, compensatory students are empowered with strong basic skills, coupled with life skills that include decision making and problem solving. These students, however, must be introduced to thinking skills in a developmental, process-oriented manner.

Instructional Strategies and Thinking Skills

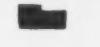
The effective schools research shows that thinking skills are more effective when integrated with subject matter and related to the students' external world. Robert Sternberg states emphatically: "Critical thinking skills should be taught in a way that maximizes the probability of their transfer to real-life situations." Thinking skills are the basis of the entire learning process. Consider implementing the following strategies in the classroom to promote higher level thinking. And remember, a strategy is only as good as the action taken to ensure that it works!

- Allow students access to a variety of resources such as media, people, materials, and models to encourage student interaction
- Recognize and give merit to students' ideas
- Structure learning opportunities to include pupil-centered activities, debate, and controversy
- Vary discussions and classroom assignments by emphasizing different thinking skills
- Use low-level skills to develop and support high-level thinking skills
- Encourage responses that use all of the senses

Activities to Promote Higher Level Thinking

Students participating in compensatory education programs often exhibit gaps in their academic learning. Because studies suggest that unsuccessful behavior is often motivated by the wish to avoid possible failure, it is imperative that educators be sensitive to the need of these students to succeed. The activities described in this article should be structured in a safe, intellectual arena that allow them the freedom to explore choices, take risks, and attain a feeling of valued accomplishments and challenge. Meaningful dialogue and the exchange of ideas should be encouraged among students and their peers. Teachers, therefore, assume the role of facilitator.

Why is a preparatory period necessary for compensatory students to master higher level thinking skills? The answer is that often the background of these students does not provide opportunities for interaction with persons who model the processes of these skills.

Thinking Strategy	Activity
Questioning strategies involve students in a process that will result in varied levels of thinking.	A mathematics class is introduced to the study of area. After practicing how to determine the area of a square (□) and a rectangle (▬), ask "What if we have a figure like ()?"

Thinking Strategy	Activity
"What if. . .?" questions set up hypothetical situations linking student imaginations with knowledge and comprehension of a topic. Their repertoire of experiences and knowledge is used as a base to build creative thoughts and gain new perspectives.	In social studies class, after students have discussed the concept of similarities and differences among people (EE 6B), pose the question: "What would happen if everyone in this room were exactly the same?"

Thinking Strategy	Activity
Students ask many questions, but the nature of their questions may range from managerial types, such as asking for permission; to fact acquisition; to concept clarification. Providing a clear purpose and adequate time for developing their questioning skills increases the level of their participation.	In language arts class, provide a short summary of a passage to be read. Ask students to prepare two or three questions they would like answered when reading. The activity can also be done before viewing a film or at the beginning of a study unit.
	Ask a migrant student to bring in an item that is familiar to him but not to the class. Place the item in a box or bag and play "20 Questions." The student with the item can only respond with "yes" or "no" answers. Students identify the item by deducing characteristics of the item from information they have acquired in the questioning process.

Thinking Strategy	Activity
Brainstorming is a strategy used to stimulate creative and critical thinking. It can be done individually or in a group. An individual's knowledge, experience, imagination, and creativity are used to generate ideas.	Teachers are all too familiar with reading children's paragraphs or stories that use mundane language such as "She was mad," or "I felt bad." Have students brainstorm a list of synonyms for these commonly used words and write them on a poster board. Have students refer to these when writing to build more colorful, precise language.
	Students from low socioeconomic homes often use common items for unusual uses. Have children brainstorm unusual uses for old shoelaces, a used inner tube, recycled paper, and an ink-dried pen. Students may "web" their ideas and write stories using their collective suggestions.
	Studying a unit of measurement, students could brainstorm items that are approximately the same unit of measurement. For example, ask students to brainstorm a list of 10 items that measure a foot or 12 inches. They could also brainstorm ways to measure a tree or find the area of a book shelf. Students then measure the various items to prove or disprove their predictions.

Thinking Strategy	Activity
Role playing is a strategy that allows students to take on the characteristics of an imaginary or real person or item. It develops thinking skills that encourage students to see other perspectives and function at higher levels of thinking. To best fulfill the purpose of the role, students must refer to their own experiences and feelings. These are then linked to their own creative and critical thinking processes and produce a meaningful experience.	When studying the economic system, students role play the various roles of consumers and producers.
	Students role play a conversation between a newly arrived migrant student and another student about the geographic makeup of the local area, school rules, and topics of interest. The new student may generate a useful list of information, and the class could develop a strategy on how to find answers to the new student's questions.
	Have students role play career possibilities that require a mathematical background. Have students project into the future and set personal and career goals. How will they get these? Who will help them attain their goals? Discuss the process of setting and attaining goals.

Conclusion

Fundamental to the effective schools research is the belief that all children can learn. Supporting this philosophical principle is the belief that all children can think, and that this ability can be fostered and developed by schools. The mission of compensatory programs is to help students master basic skills. This can be done without excluding thinking skills. Research shows that when higher level thinking skills are integrated into the curriculum and incorporated into teaching strategies, students make academic gains. Promoting thinking skills in these students means promoting their future.

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DEVELOPING THE THINKING OF STUDENTS OF LIMITED ENGLISH PROFICIENCY

Written by Elisa Gutierrez
Director of Bilingual Education

Among the characteristics found by Tom Carter and Eugene Garcia in their studies of effective bilingual education programs are high expectations for student achievement and a positive school climate. These findings complement studies that link language and emotional growth to the development of higher order thinking skills.

Bilingual education or special language programs are implemented in public schools to enhance the learning ability of limited English proficiency (LEP) students and their use of the English language. To close the achievement gap between these students and other populations, teachers must not only teach them English, but also develop their thinking skills for strong academic achievement in all required subjects.

The effectiveness of these programs cannot be measured by comparing achievement scores for TEAMS and nationally normed tests for students in bilingual education with those for other populations. All LEP students, by definition, achieve on or below the 40th percentile in English reading and language. Effectiveness is better described by measuring the performance of former LEP students after they have crossed over the 40th percentile in English reading and language and have been placed in English classes. Former LEP students from good programs demonstrate the ability to:

- Master essential elements for English classes
- Master essential elements for other required subjects
- Pass exit level TEAMS, and
- Graduate from high school.

When former LEP students are routinely placed in correlated language arts and compensatory programs; are lacking in their ability to master the essential elements for science, mathematics, and other required subjects; and drop out of school prior to graduation, their educational needs have not been met. Bilingual program goals strive to (1) assist these students to master minimum basic skills tested by TEAMS, (2) narrow the gap between LEP and former LEP basic skills scores and national norms, and (3) retain students in school until graduation requirements have been met.

For students of English as a second language to achieve listening, speaking, reading, and writing skills comparable to those of native English speakers of the same educational level, they must develop both higher level cognitive and affective skills. The capacity, for example, to perform creative and judgmental tasks is dependent upon self-assurance and a positive self-concept.

The instructional staff of bilingual programs constantly seek ways to improve instruction. However, although teacher preparation programs include courses in language acquisition, psycholinguistics, and methods for instructing LEP students, linking theory to practice is not always easy. Two types of studies in school improvement literature are important for bilingual education.

Effective Schools Research

Research has identified characteristics of effective schools, where all students achieve in the basic skills. Among the characteristics found by Tom Carter and Eugene Garcia in their studies of effective bilingual education programs are high expectations for student achievement and a positive school climate. These findings complement studies that link language and emotional growth to the development of higher order thinking skills. Among the generalizations that have most influenced bilingual educators are these:

- There is a close link between the development of higher order thinking skills described in Benjamin Bloom's taxonomy for the cognitive domain and his lesser known taxonomy for the affective domain, shown in Figure 1. In particular, there is an important relationship between affective behaviors and language learning. For students of English as a second language to achieve listening, speaking, reading, and writing skills comparable to those of native English speakers of the same educational level, they must develop both higher level cognitive and affective skills. The capacity, for example, to perform creative and judgmental tasks is dependent upon self-assurance and a positive self-concept.
- Language skills themselves are examples of higher level thinking skills and, once mastered, they provide students with the capacity to understand and use multidisciplinary approaches for applying concepts among different subjects. For example, when students know how to use word tree techniques for developing vocabulary, it is easier for them to classify plants and animals in science.
- Students of brain functions have long known that there is empirical evidence to show that the path to higher level thinking is less like three runners in a race in cognitive, language, and affective lanes, and more like a relay race where the first runner opens a door with the power of positive feelings, the second goes through this door to develop language skills, and the third completes the race to reach higher level thinking areas. These routes or mental paths are not theoretical and can be traced with equipment that records the electrical activity of different parts of the brain.

Language Studies

A second type of study for developing thinking skills for LEP students is exemplified by the work of Kenji Hakuta, a professor from the University of California. His studies on bilingual education programs throughout the world show that successful programs make greater use of primary language instruction as a bridge to English or other second languages and stress language awareness. Language awareness has been compared to children looking through a glass window and, at a late point in childhood, becoming aware of the glass itself.

Since awareness is an important affective skill, this reinforces the belief of other investigators that cognitive and affective skills development go hand-in-hand with raising academic achievement. Hakuta's instructional variables are abstract and better illustrated in the activities that follow for teachers to develop particular thinking skills. Technical terms are included in parenthesis to guide teachers interested in further reading on this subject. Activities are not assigned to grades, since a more practical approach to teaching LEP students is to design activities for beginning, intermediate, and near-proficient users of English. These activities are designed to coordinate cognitive, affective, and language development and may be used during primary language or ESL instruction.

Language skills themselves are examples of higher level thinking skills and, once mastered, they provide students with the capacity to understand and use multidisciplinary approaches for applying concepts among different subjects.

Thinking Skill: Analysis

Sorting Communication Into Components

Learner Outcome	Classroom Activities
Students will identify the sounds of spoken English. *(phonological awareness)*	• Students identify sounds of oral English after hearing a story read by the teacher. • The teacher writes sounds identified by children on the board. These may include vowels or sounds represented by more than one letter such as sh, th, oa, or oo. • Students identify sounds from flash cards and later use them to construct words on a flannel board.
Students will identify nouns, verbs, and adjectives. *(word awareness)*	• Ask children to identify objects they wish to talk about. In small groups, students identify nouns for each item. The teacher writes these words on the board and provides words the group was unable to identify. Through group responses, students break the words into letters and rearrange them to form new words. The teacher includes letter combinations that are not words and asks students to identify words and non-words. Students take turns at the board to lead the group. • Students repeat this sequence for verbs and adjectives. • Students in small groups are asked to combine letter cards to make as many simple words as possible. • Students invent new words in their groups.
Students will identify and use basic sentence patterns. *(syntactic awareness)*	• Group students of various language and mental abilities. These heterogeneous groups may also include students from different socioeconomic backgrounds and primary language groups. The teacher models basic sentence patterns orally. Each group is asked to identify different word arrangements such as: noun - verb or noun - verb - noun • Students must then develop sentences with word cards. These words may be color coded to give students clues as to parts of speech. Instead of naming the parts of speech, these may be referred to as "name words," "action words," or "modifiers."

Thinking Skill: Synthesis

Developing Written Representations of New Ideas

Learner Outcome	Classroom Activities
Students will demonstrate the ability to solve word problems in mathematics by using the same methods for identifying main idea of a passage.	• Ask students to compile a list of steps that can be used to identify the main idea in a reading selection. They may use references, question each other and the teacher, or ask the librarian for help. Next, ask groups of students to keep these steps in mind while developing a process for solving written mathematics problems.
Students will demonstrate an increase in the use of standard grammatical details in written compositions.	• Provide students with a writing tablet and ask for daily entries in these private "journals," telling the teacher about happy, sad, or other emotional events. The teacher notes errors in spelling, syntax, noun-verb agreement, and capitalization but does not correct them. Instead, the teacher responds to entries everyday, modeling appropriate grammar in warm, supportive statements to the student.

Thinking Skill: Synthesis

Perceiving Ways in Which Experience May Be Organized To Form a Way of Thinking

Learner Outcome	Classroom Activities
Students will demonstrate the ability to describe detail in creative writing.	• Ask students to write short compositions about feelings and sensations to present in oral class reports. These topics may be used: • Do you know what the ocean is like? Do you like to think about it? Close your eyes and imagine a beach and ocean you have seen and heard. Describe it to someone who has never been there. • Do you know how to tie your shoelaces? Give directions to someone who has never done this. • Explain why you need to know how to add in order to multiply. • Explain how you identify the important details of a story. Use who, what, when, and where as subtopics for your paper. • Describe your summers for the past two years. Explain how they were alike and different.

Thinking Skill: Evaluation

Judging the Value of Material and Methods for Given Purposes

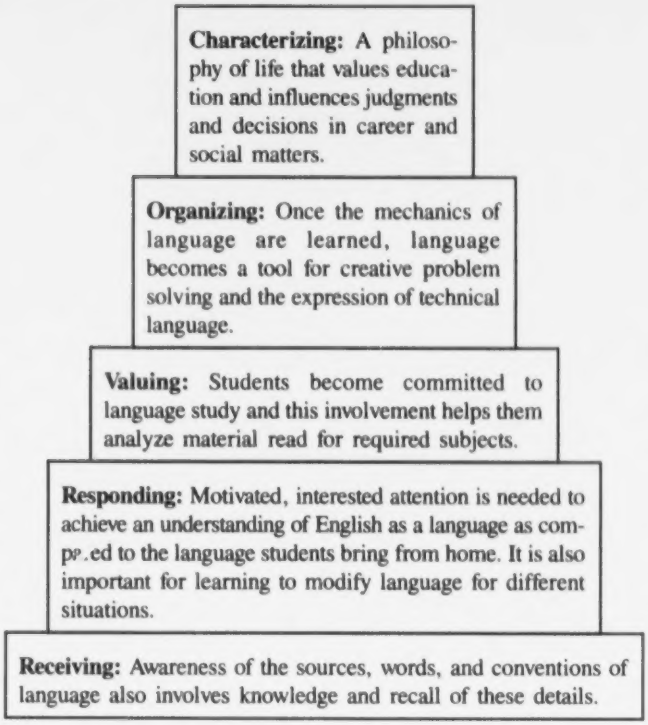
Learner Outcome	Classroom Activities

Students will demonstrate the ability to change language to fit different situations. *pragmatic awareness)*	• Through heterogeneous grouping (cooperative learning), ask students to identify different ways that communication changes for different situations. The teacher may contribute initial variations of intonations, word choice, and facial expressions. Students may identify sentence length, intended meaning, and use of laughing, crying, pausing, and eye contact.
	
	• Through group activity, develop skits for dramatizations. Very shy children may participate better when puppets are used. Topics can include:
	  • a variety of settings to demonstrate polite behavior
	  • language variations to give the same set of directions to a younger child, parent, and a principal
	  • language variations to invite peers, relatives, and neighbors to family celebrations
	  • language variations when asking for favors from persons of different age groups

FIGURE I

Bloom's Taxonomy of the Affective Domain*

Highest Level of Affective Domain


Characterizing: A philosophy of life that values education and influences judgments and decisions in career and social matters.
Organizing: Once the mechanics of language are learned, language becomes a tool for creative problem solving and the expression of technical language.
Valuing: Students become committed to language study and this involvement helps them analyze material read for required subjects.
Responding: Motivated, interested attention is needed to achieve an understanding of English as a language as compared to the language students bring from home. It is also important for learning to modify language for different situations.
Receiving: Awareness of the sources, words, and conventions of language also involves knowledge and recall of these details.

Lowest Level of Affective Domain

*Levels of Bloom's affective domain and examples of applications to language learning and cognitive development.

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VOCATIONAL EDUCATION

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DEVELOPING CRITICAL THINKING SKILLS IN THE HEALTH OCCUPATIONS LABORATORY

Written by Jim Keeton
Director of Secondary Health Occupations Programs

In 1981, Weinstern and Laugman observed: "Little has been done to design programs of study that would develop, with reasonable assurances, the ability of students to make valid inferences leading to logical conclusions, which are essential skills for critical thinking." This article will show how the health occupations program promotes critical thinking by providing an environment and teaching strategies that are receptive to the development of these skills. The opportunity for students to develop critical thinking skills is greatly enhanced by the role of the instructor who strengthens their ability to function as self-directed learners.

Secondary students in health occupation courses learn basic skills related to all health occupations, as well as skills related to specific occupations in the health care field. These courses are taught as laboratory programs in a school classroom or in a local community hospital. Each setting makes its own contribution to the specific objectives of the program: Classroom experiences focus on teaching basic theories and procedures; the clinical setting actively involves students in learning procedures that reinforce theoretical concepts and classroom experiences.

Not only do students learn basic skills that can be applied later as employees in a health care facility, they also develop critical thinking skills that can be applied over a lifetime. These skills include: (1) distinguishing relevant from irrelevant information, (2) determining the factual accuracy of a statement, (3) determining the credibility of a source, (4) recognizing logical inconsistencies in a line of reasoning, and (5) determining the strength of an argument or claim.

A clinical setting in a hospital provides a sound environment for the health occupations program and numerous advantages for the students. Students learn to function in a disciplined manner with clinical per-

The students observe how the clinical staff use their basic skills in different situations that require reasoning, analyzing, evaluating, and decision making. Similarly, students learn to apply basic skills to their health care responsibilities and encounter opportunities to develop higher level thinking skills they will use throughout their lives.

One of the important aspects of learning to use critical thinking skills is the development of a positive attitude toward using reasoning processes.

sonnel, the instructor, and patients, all of whom set high expectations of them. The students observe how the clinical staff use their basic skills in different situations that require reasoning, analyzing, evaluating, and decision making. Similarly, students learn to apply basic skills to their health care responsibilities and encounter opportunities to develop higher level thinking skills they will use throughout their lives.

Instructional Strategies That Develop Critical Thinking

Classroom Basic Skills

Basic theories and concepts are developed and learned in class before students begin their internship in a clinical facility. The purpose of developing these basic skills is to give students a reference point for entering into higher levels of thinking. They may be related to interpersonal and patient relationships, anatomy and physiology, vital signs, first aid and cardiopulmonary resuscitation, and other areas related to health care occupations.

When learning concepts and skills that improve interpersonal relationships, they might be asked to develop their own definition of a professional patient relationship, justifying their definition by applying it to a realistic situation and discovering the results. In the process, students learn to understand the legal and ethical responsibilities of health care workers and the reasons for high professional standards.

Clinical Application

After students are tested on their understanding of basic skills, they are assigned to a department responsible for specific aspects of health care. The intent of this strategy is to teach students not only how to apply these basic skills, but to know when to apply them to the immediate situation. In the clinical facility, students are responsible for monitoring patients as they receive medical treatment and noting their progress. This experience gives students a comprehensive overview of the procedures performed in treating a patient's illness. With the instructor and clinical personnel, they discuss their observations and activities and how these relate to theoretical concepts. The teacher serves as a catalyst, providing a more indepth look at the observed procedures or closely related information, depending on student needs.

Students learn, either by observing or participating, the actual procedures performed by hospital personnel. They know they must not only identify specific skills observed in a procedure, but must also be aware of related factors that may affect the results, such as the patient's emotional state, attitude, and level of understanding. One of the important aspects of learning to use critical thinking skills is the development of a positive attitude toward using reasoning processes. Students are held responsible for using these skills to provide additional conclusions, based on their observations, that support the basic theory they have learned.

As interns assigned to surgical nursing, they must recall the process for taking vital signs, aseptic techniques, and other basic skills related to patient contact, always keeping in mind the importance of interpersonal relationships in the process. As in a hospital, patients must feel comfortable and not be concerned about the person administering different procedures. Students are asked to develop reports, using resource materials and records kept from clinical observations or hands-on activities, that help students draw conclusions and make logical recommendations.

When students are assigned to the emergency room of a hospital, their basic anatomy and physiology skills can be readily applied. They may be asked by the instructor, for example, to assess a patient's condition or to provide written or oral reports on orthopedic injuries, lacerations, cardiac symptoms and respiratory distress. In addition, the actual situations students encounter may call for communication with the patients and their families, providing more opportunities to exercise positive human relations skills.

The following charts illustrate the objectives students learn over a period of six weeks in the radiology and medical laboratory departments. Students rotate from the classroom to the laboratory building a foundation of knowledge and skills expanded upon by the teacher and clinical staff.

Radiology Department Rotation

Objective

Internship students will have the opportunity to see how x-rays have become one of the most widely used medical controls and are the backbone of the medical investigation of the symptomatic patient. They will observe the importance of using good human relations communication skills.

Radiology Department Guidelines

The rotation of the radiology internship student will include the health occupations core and the concepts and skills associated with the specialty of radiology. The student will be provided opportunities to:

- Read the department policies on safety
- Assist the patient care assistant when transporting patients to and from the radiology department
- Observe film processing and basic darkroom skills
- Observe radiographic procedures from the control area
- Observe methods of record keeping
- Observe film critique

Students will not enter the radiographic room while a procedure is being done. They will act under the instruction of a licensed professional and never follow these guidelines independently. All of the radiology guidelines will be met through the rotation task sheet and signed by the department supervisor.

As students move through different departments of the clinical facility, research assignments focus on developing the abilities of students to compile, interpret, analyze, synthesize and evaluate.

Task Sheet—Radiology Rotation

Objective	Observed	Assisted
1. Read department policies	_____	_____
2. Film processing cycle	_____	_____
A. Developing	_____	_____
B. Rinsing	_____	_____
C. Washing	_____	_____
D. Drying	_____	_____
3. Darkroom skills	_____	_____
4. Radiographic procedures		
A. Upper extremities	_____	_____
B. Lower extremities	_____	_____
C. Chest	_____	_____
D. Abdomen	_____	_____
E. Vertebral column	_____	_____
F. Skull	_____	_____
5. Contrast studies		
A. Cholecystogram (gall bladder)	_____	_____
B. Intravenous pyelogram (IVP)	_____	_____
C. Upper gastrointestinal series (UGI)	_____	_____
D. Lower gastrointestinal series (Barium Enema)	_____	_____
6. Specialized radiographic procedures		
A. Angiography	_____	_____
B. Ultra sonography	_____	_____
C. Xerography (mammogram)	_____	_____
D. Radioisotope	_____	_____
7. In the above examinations (4, 5, & 6), know why they are being taken and what patient preparation is needed	_____	_____
8. Methods of record keeping		
A. Filming of radiographic reports	_____	_____
B. Film retrieval	_____	_____
9. Radiation protection		
A. Note how the "critical" organs are protected		
• Blood forming organs (red bone marrow)	_____	_____
• Lens of the eye	_____	_____
• Gonads (male & female sex glands)	_____	_____
• Skin	_____	_____
B. Radiation monitoring		
• Film badges	_____	_____
• Pocket dosimeter	_____	_____
C. Safeguards employed during a fluoroscopy for the patient & the technologist	_____	_____
10. CAT scanning		
A. Head	_____	_____
B. Chest	_____	_____
C. Abdomen	_____	_____
D. Vertebral column	_____	_____

_____

Clinical Supervisor

Medical Laboratory Department Rotation

Objective

Students involved in the internship program will be exposed to as many of the medical laboratory departmental functions as possible. They will be allowed to observe or assist in the performance of a function under the direct supervision of a licensed medical laboratory technician. They will be expected to learn the stated objectives and perform certain tasks pertinent to the objectives. They will have an opportunity to appreciate the importance of the medical lab department in diagnosing patients.

Medical Laboratory Guidelines

The rotation of medical laboratory internship students will include the health occupations core and the concepts and skills associated with the occupation of medical laboratory technician. They will be provided opportunities to:

- Observe or assist with routine tests in the medical laboratory under supervision of the medical technologists or other qualified individuals, utilizing prescribed procedures in urinalysis, hematology, serology, microbiology, bacteriology, chemistry, histology, cytology, electron microscopy, blood bank and blood gases
- Develop an awareness of slide preparation
- Develop an awareness of culture preparation
- Observe the operation of instruments and equipment used in the medical laboratory

Students will act under the instruction of a licensed professional and never follow these guidelines independently. All of the medical laboratory guidelines will be met through the rotation task sheet and signed by the department supervisor.

Students resume responsibility for defining their own learning objectives, planning their individual programs, and evaluating their own progress.

Task Sheet—Medical Laboratory Department

Objective	Observed	Assisted
1. Hemotology	_____	_____
A. Slide preparation & examination	_____	_____
B. Operation of the following instruments:		
• coulter Ortho ELT-15	_____	_____
• slide stainer	_____	_____
• micro-hematocrit	_____	_____
C. Erythrocyte Sedimentation Rate	_____	_____
2. Urinanalysis		
A. Chemical analysis with chemstrips (ph, protein, glucose, ketones, bilirubin, blood)	_____	_____
B. Specific gravity	_____	_____
3. Blood Collection		
A. Micro draws	_____	_____
B. Macro draws		
• syringe	_____	_____
• vacutainers	_____	_____
4. Blood Bank		
A. Type and Rh	_____	_____
B. Crossmatch	_____	_____
C. Blood components (Packed RBC, FF Plasma, Cryopreciptate, etc.)		
• Issuing	_____	_____
• Storage	_____	_____
D. Tissue Typing	_____	_____
5. Microbiology		
A. Culture inoculation	_____	_____
B. Gram stain preparation	_____	_____
C. Sensitivities	_____	_____
D. Inoculation of student's fingertips		
• ½ plate before handwash	_____	_____
• ½ plate after handwash	_____	_____
• observation of colony growth in 24 hours	_____	_____
6. Chemistry		
A. Operation of the following instruments:		
• Astra	_____	_____
• ACA	_____	_____
B. Blood separation (centrifugation)	_____	_____
7. Serology		
A. Reagents	_____	_____
B. Agglutination tests	_____	_____
8. Histology		
A. Tissue preparation	_____	_____
B. Operation of Instruments	_____	_____
C. Special Stains	_____	_____
9. Cytology		
A. Pap stains	_____	_____
B. Examination of malignant cells	_____	_____
10. Blood Gases		
11. Electron Microscopy.		
A. Processing	_____	_____
B. Ultramicrotomy	_____	_____
C. Microscopy	_____	_____
D. Photography	_____	_____

_____

Clinical Supervisor

Resource Materials

As students move through different departments of the clinical facility, research assignments focus on developing the abilities of students to compile, interpret, analyze, synthesize and evaluate. The teacher individualizes the course, basing long- or short-term assignments on the capabilities of each student.

Students are taught to recognize that the information related to procedures performed in their presence is not necessarily complete, and that skills for selecting and using additional resource materials should be developed. Library and study skills are reviewed and practiced, giving instructors a tool to help students develop skills in selecting alternative resources for specific situations. Self-directed learners will use these skills independently, without the close supervision of the instructor.

Decision Making

Students assume responsibility for defining their own learning objectives, planning their individual programs, and evaluating their own progress. They write their goals for the course and plan a program around the objectives and goals that they have set. These plans are reviewed with the instructor to ensure that course objectives and goals will be met. The entire process requires critical analysis and decision making.

In the clinic, students evaluate data carefully and exercise logical principles before making judgments. Thus they learn to carefully consider all aspects of the situation related to a specific patient's care. They also learn to prioritize reasons for tracking the patient and must defend their decisions. By giving students opportunities to make choices, the value of their learning experiences is enhanced.

Recognizing and Solving Problems

The techniques used to identify and solve problems are best observed and learned in the clinic. Students soon learn that they can use the diagnostic techniques applied in medical practice to develop their own skills in recognizing and solving problems. Since situations in the clinical setting continually change, students constantly practice making decisions for the circumstances of the moment.

Conclusion

Students of health occupations courses do more than just simply receive instruction. By individualizing classroom assignments and manipulating the clinical environment, students move from lower to higher levels of thinking—skills they can use outside the health profession for a lifetime.

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IMPROVING TRADE AND INDUSTRIAL STUDENT THINKING SKILLS

Written by James Cogdell
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Probably no factor affects an organization's effectiveness more than its employees' ability to solve problems quickly and accurately. Don't employees—especially electricians, assembly mechanics, and other paid troubleshooters—already have these skills? Yes, but in most cases, training refines skills and reduces the amount of time it takes to solve problems. *(NASSP Curriculum Report)*

Critical Thinking: What is it Really All About?

British physician and educational consultant Edward deBono believes that schools are particularly negligent when it comes to developing what he calls perceptual thinking. He argues that poor thinking often is due to errors in the perception of a problem, rather than in its analysis. *(NASSP Curriculum Report)*

Teachers need to ask, "What do I want students to know and be able to do by the end of this course?" Planning experiences for students that encourage dialogue and peer interaction and promoting good questions are important. Strategies might include beginning each class with a controversy, using silence to encourage student reflection, arranging the classroom to stimulate interaction, creating a supportive environment and, if possible, occasionally extending class time.

Although problem solving and the study of logic are popular methods of teaching critical thinking, there are limitations to these approaches. "A major assumption underlying both approaches is that critical thinking skills are best taught in and of themselves separate from specific subject matter, and the students will be easily able to apply them across disciplines." *(Meyers)*

Probably no factor affects an organization's effectiveness more than its employees' ability to solve problems quickly and accurately.

Problem solving is not all there is to critical thinking; students need to be able to raise relevant questions and critique solutions without necessarily posing alternatives. If teachers believe that logic and problem solving are the primary means of accessing critical thinking skills, they may "pass the buck," believing those skills will be taught elsewhere.

The logical, objective methodology that dominates sciences, including the science of teaching, is only one of many critical thinking perspectives that can help us make sense of the world and order our experiences. Each academic discipline offers its own unique window on reality.

What Techniques Appear to be Effective?

"Thinking and talking about thinking begets thinking." *(Costa)* Because levels of thinking are cumulative, teachers must arrange instructional activities sequentially, giving students adequate time to move from data gathering, to processing, to higher thought levels.

Thinking skills include such functions as forming concept, interpreting, inferring, generalizing, and applying principles. Teaching these skills involves introducing a skill, repeated guided practice, extending the skill to new contexts and media, and practicing again until students can use it independently. This progression is especially true when acquiring manipulative skills like those taught in vocational education that are related to specific jobs. All aspects of instruction should reflect this sequence, such that the learning of skills, rather than subject matter alone, becomes a major curricular emphasis.

By "basic skills," educators usually mean reading, writing, and arithmetic. Some, however, suggest that thinking and reasoning skills are even more basic to students' educational success. Mastery of facts in isolation is insufficient because facts don't exist in isolation.

In trying to define "thinking skills," Lipman and his colleagues have come up with 34 mental activities such as making inferences, deciding, remembering, making distinctions, and detecting fallacies. The way to teach these components, he believes, is to enwrap them in contexts that are interesting and meaningful to children and young adults. *(Olson)*

Hart says that learning is a gradual process in which "the brain builds on its own experience." He suggests that the best approach to learning may be to assign students to work out the solution to a real problem of interest to them, perhaps designing an ideal home study desk or a system to finance school sports. Another example of a problem-solving technique might be to build homes as students do in building trades classes across the state. In a laboratory setting, students prepare for jobs, but they also have an opportunity to focus on concurrent goals related to work habits, attitudes, life skills, personal relationships, health, and many others.

Edward deBono, believes that schools are particularly negligent when it comes to developing what he calls perceptual thinking. He argues that poor thinking often is due to errors in the perception of a problem, rather than in its analysis.

A short-term strategy for introducing critical thinking skills might involve teaching analytical vocabulary by defining such terms as "premise," "reason," "conclusion," and "inference" within the regular curriculum where they can be applied appropriately as they are learned. Curriculum guides could emphasize the importance of thinking skills by listing the skills to be taught, extending those skills in a developmental sequence across all grades, and including simple lesson plans.

Paul's long-term strategy is to develop a "dialectical" approach to problem solving, involving what he terms "dialogical reasoning"—thinking critically and reciprocally within opposing points of view. A class, for example, could be divided to debate optional solutions to a problem.

In guiding students toward a solution to a problem, teachers can suggest useful strategies, define the answer so students will know if they have solved it, consider alternative approaches, evaluate all information bit by bit, and then "give the incredible brain an opportunity to solve it—in its own way and its own time." *(Hart)*

Eight Steps to Successful Problem Solving

Students enrolled in vocational courses could benefit from the following eight step problem-solving process offered by Paul:

1 **Premise**
Select a simple statement of a problem for which you want to find a cause.

2 **Reason**
Write down a full description of the problem, including when it first surfaced, and how extensive it is.

Dialogical reasoning and **inference** occur in steps three through seven:

3 Identifying distinctions or differences. What is unique or peculiar about this problem?

4 Determine what changes happened about the time the problem first occurred.

5 Write down all possible causes of the problem.

The logical, objective methodology that dominates sciences, including the science of teaching, is only one of many critical thinking perspectives that can help us make sense of the world and order our experiences. Each academic discipline offers its own unique window on reality.

6 Test for the most probable cause.

7 Verify the most probable cause by doing something to correct the problem.

8 **Conclusion**
Recommend a solution that eliminates the cause of the problem.

To the full extent of their individual abilities, students will be provided the opportunity to develop the ability to think logically, independently, and creatively, and to communicate effectively. By using a systematic approach to problem solving, trade and industrial education can "improve student skills in thinking critically and solving problems." *(1986-1990 Long Range Plan of the State Board of Education)*

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SEND US YOUR THINKERS

Written by Berry Sullivan
Director of Marketing Education

While some researchers argue about when and where to address higher order thinking skills, growing numbers of business and industry groups have become increasingly vocal about what they want the educational system to do for them. They want workers who can solve problems, make decisions, participate in planning, communicate, demonstrate interpersonal skills, and perform basic job tasks. The dynamic nature of the workplace has increased the importance of a prospective employee's ability to learn—today's worker will change jobs as many as ten times in a lifetime, will often learn new skills, and must know how to adapt existing skills to new and different environments. Reasoning and problem solving are and will continue to be premium skills in this changing work world. *(Laster)*

Which Thinking Skills—and for Whom?

As society prepares for the 21st century, educational leaders are beginning to emphasize the importance of higher order thinking skills "after an era of back to the basics." *(Champagne)* How to teach them is, however, subject to question and discussion. The domain of higher order thinking skills is broad and unspecific, and there is considerable naivete in the public's perception of the conditions under which these skills are learned. In response to reform pleas, some states have mandated increases in the number of mathematics and science courses students must complete before graduating from high school. Such requirements are based on a belief that reasoning, problem solving, and other learning skills are best taught in these courses. For a short time, there was little disagreement with this perception. However, many educators now recognize that these skills can and must be addressed in all subjects, across all grades, in all schools.

Growing numbers of business and industry groups. . .want workers who can solve problems, make decisions, participate in planning, communicate, demonstrate interpersonal skills, and perform basic job tasks.

Rather than add a course in higher order thinking that is divorced from any specific subject, other educators take the view that the development of these skills has always been, and should continue to be, the goal of each individual discipline. *(Morris & Laster)* The challenge is to restructure or reposition the delivery of instruction—changes in teaching methods are often more difficult to implement than changes in subject matter. *(Morris)* The implications for preservice and inservice training for teachers are obvious and critical.

As schools seek ways to help students learn and develop competencies for a 40- to 50-year work life, issues will arise related to what to teach; when to teach; quality, quantity, and sequencing of courses; and academic "rigor," among others. There will also be a critical need for general and vocational education personnel to plan and work together more frequently to keep abreast of educational trends and demands.

Just as educators are beginning to work together on basic academic issues, it is apparent that cooperation and coordination can also help all educators address the need for higher order thinking skills. John Goodlad found in his comprehensive study of schooling that most training in thinking skills occurred in courses for college-bound students. Compare this observation with a finding that approximately 80 percent of the jobs in America do not require a college degree, and most students will not obtain one. *(National Commission on Secondary Vocational Education)* It is all too apparent that vocational education teachers must provide thinking skills in their courses.

Skills for a Fifty-Year Work Life

The entire field of vocational education curricula presents a wealth of opportunities to infuse and integrate activities for developing thinking skills essential to success in the work place. While decision making, problem solving, planning, communication, and interpersonal skills have always been recognized by vocational educators as important to their students, too often the educational objectives and learning activities needed to help students acquire these skills have been left out of instruction. With the implementation in 1988 of *Career Opportunities in Texas: A Master Plan for Vocational Education*, the development of higher order skills has become a real and regular part of instruction in all subjects.

The comprehensive master plan includes new and revised courses with essential elements relevant to future employment needs. Learning strategies and activities for higher level skills will be infused into new curriculum documents to develop these essential transferable competencies. A significant activity will involve the developers of the curriculum in training activities to help teachers use these new materials and learning activities in varied settings. Traditionally, vocational education students have generally been provided varied learning settings, including classroom, laboratory, shop, on-the-job cooperative programs, and the career and leadership activities of vocational student organizations.

The following lists suggest strategies for vocational teachers to consider as they plan instruction to develop thinking skills in their students. These strategies can be incorporated into a variety of activities such as role playing, case studies, simulations, brainstorming, questioning, and debate.

'Rather than add a course in higher order thinking that is divorced from any specific subject, other educators take the view that the development of these skills has always been, and should continue to be, the goal of each individual discipline.'

Morris & Laster

Higher Level Skills Adaptable to Vocational Education Instruction

Thinking and Reasoning Skills

- Distinguish between fact and opinion
- Recall ideas, facts, and other information accurately from memory
- Explain the main idea in another's oral or written communication
- Try out or consciously attempt to use previously learned skills or knowledge in a new situation
- Interpret feelings, ideas, or facts from one's own personal viewpoint or values
- Defend one's opinion, viewpoint, or position
- Compile ideas, notes, and materials into a single report
- Carry out oral or written instructions given by another person
- Explain the functions of different departments and their relationships within same business
- Analyze features and benefits of goods and services and reason out customer objections

Problem-Solving Skills

- Explain the process and steps of problem solving
- Recognize or identify the existence of a problem
- Ask appropriate questions to identify or verify the existence of a problem
- Enumerate the possible causes of a problem
- Identify important information needed to solve a problem
- Generate or conceive possible alternative solutions to a problem
- Describe likely consequences of possible alternative problem solutions
- Compare or evaluate possible alternative solutions to select the best course to pursue

John Goodlad found in his comprehensive study of schooling that most training in thinking skills occurred in courses for college-bound students. Compare this observation with a finding that approximately 80 percent of the jobs in America do not require a college degree, and most students will not obtain one.

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Decision-Making Skills

- Estimate the potential likelihood of an event's occurrence and probable consequences
- Project resource requirements for alternative scenarios
- Determine relevance and quality of available data and information
- Identify information that is needed and could be located or generated
- Distinguish between values and assumptions underlying various options
- Use appropriate processes or options to facilitate making a decision

Interpersonal Skills

- Work effectively under different kinds of supervision
- Be on time for activities and appointments
- See things from another's viewpoint
- Engage appropriately in social interactions and situations
- Initiate task-focused or friendly conversation with other individuals
- Speak with others in a relaxed and self-confident manner
- Take responsibility and be accountable for one's own judgments, decisions, and actions

TEACHING THINKING IN INDUSTRIAL TECHNOLOGY EDUCATION

Written by Neil Ballard
Director of Industrial Technology Education

The industrial arts, of all disciplines in the public schools, has a rich history of helping students understand their technical heritage. Aside from this positive contribution, however, educators in the discipline have acted to update the curriculum because of rapid developments in industry, technology, and society. The result is a completely new curriculum, which was implemented in the schools of Texas in September 1988. Along with the new curriculum comes a new name for the discipline: industrial technology education. The new name is coupled with new direction: focus on the development of technological literacy and problem-solving skills. Major aspects of the program follow in this article.

Industrial Technology Education

Assumptions

The industrial technology curriculum and teaching strategies are based on the following assumptions:

- To be technologically literate, all students need a basic understanding of how industry and technology function.
- The primary focus of the program is to help students develop the ability to solve problems and become technologically literate.
- The program must include specific experiences for students in three technological systems: communication, energy, and production.
- To enhance the development of fundamental concepts, all courses should be based on activities that are taught in a technology laboratory.
- Technology is better understood if students are given opportunities to design and produce technological systems and products.
- The universal systems model (input-process-output-feedback) is a fundamental concept that explains how technological systems operate.
- The study of technology is a practical link to understanding and appreciating basic academic education.

To be technologically literate, all students need a basic understanding of how industry and technology function.

Objectives

Industrial technology education provides opportunities for students to:

- Investigate the nature of the technological world—past, present and future—and its influence on our society
- Develop an awareness and appreciation of the importance of technology and the relationship between communication, energy, and production technology
- Explore entrepreneurship and its place within the free enterprise system
- Exhibit responsibility and leadership skills by using democratic principles
- Develop competencies in the safe use of tools, machines, materials, and the process of technology
- Solve technological problems through the creative application of other school subject matter
- Develop an awareness of and interest in career opportunities and leisure-time activities available in our society

Definition

Industrial technology education draws its content from the broad discipline of technology that relates to industry. Specifically, industrial technology education is an investigation of industry, a socioeconomic institution that researches and designs processes that use human and material resources to produce goods, services, and information to meet the needs of individuals and society.

Rationale

Since our culture is distinctly characterized as technological, it follows that schools should teach students to understand the technological culture in which they live. Industrial technology education teaches students about their environment, to enable them to make rational decisions about their daily lives and have control over their futures.

New Program Direction

The assumptions, objectives, definition, and rationale of the new curriculum point to a new direction for the discipline. The traditional approach to industrial arts has focused on skills that allowed students to construct beautiful, useful items. In contrast, the new program focuses on equipping students with an ability to solve problems in a contemporary society they clearly understand. Industrial technology education contains these new elements:

- The scope of the curriculum is defined by three technology areas: communication, energy, and production.
- The curriculum has no prerequisites and fewer courses that are broader in scope than the industrial arts program.

Since our culture is distinctly characterized as technological, it follows that schools should teach students to understand the technological culture in which they live. Industrial technology education teaches students about their environment, to enable them to make rational decisions about their daily lives and have control over their futures.

- Learning activities focus on concept development and problem solving, rather than skill development.
- Courses focus on the process and systems of industry and technology encompassing communication, energy, and production.
- Learning activities focus on how the processes and systems of industry and technology currently function within our society. Activities simulate actual technological systems that require capital, materials, people, information, and energy.
- The curriculum incorporates learning how to use contemporary technology such as computer aided drafting, robotics, computer numerical control, computer integrated manufacturing, and equipment related to telecommunications.

Since the new curriculum stresses concept development and problem solving skills, it provides students with a rich opportunity to develop and enhance their thinking skills. Many, if not all, of the following thinking skills identified by Irving Sato, director of the National and State Leadership Training Institute on the Gifted and Talented, can be developed or enhanced in industrial technology courses.

Thinking Skills

Critical thinking

- Define the meaning or interpret
- Judge with criteria
- Test assumptions
- Give supportive evidence
- Differentiate fact from fiction
- Note ambiguity
- Specify the intent or purpose
- Check reliability

Creative thinking

- Substitute
- Combine
- Rearrange
- Redesign
- Add to
- Adapt
- Design
- Amend
- Minify
- Maximize
- Brainstorm
- Hypothesize
- Restate
- Modify
- Alter
- Create analogies
- Reverse
- Rename
- Check credibility
- Relate conclusions
- Verify meaning
- Prove
- Justify
- Make an inference
- Criticize

The traditional approach to industrial arts has focused on skills that allowed students to construct beautiful, useful items. In contrast, the new program focuses on equipping students with an ability to solve problems in a contemporary society they clearly understand.

When students see congruencies between activities in the classroom and activities in the work world, they are naturally motivated to learn.

Problem solving

- Define problem
- Hypothesize
- Collect data
- Text hypotheses
- Verify solution
- Apply solution

Logic

- Reason inductively
- Reason deductively
- Relate
- Sequence
- Conclude
- Identify the pattern
- State the rule
- Reorganize the structure

A Holistic Teaching Strategy

Since the scope of the new curriculum has broadened to include communication, energy, and production technology, teachers have an opportunity to show relationships between these areas. A common way to convey this concept is to have students undertake an enterprise project. Teachers structure the project so that the students themselves design, test, manufacture, and market a product of their own choosing. By using this teaching strategy, teachers reflect in their classroom, as best they can, the procedures used in our free enterprise system. In doing so, students quickly realize the relevance of the procedures they are studying. When students see congruencies between activities in the classroom and activities in the work world, they are naturally motivated to learn.

Teaching Thinking Skills Through Enterprise

The enterprise, as a teaching strategy, puts students in control of its success or failure. If they plan well, and make good management decisions, the enterprise is likely to be successful. If not, they suffer the consequences of making bad decisions, rather than reaping the accolades and profits of making good decisions. The example that follows identifies activities conducted in a typical enterprise project, demonstrating how critical, creative, problem-solving and logic skills are developed or enhanced.

Enterprise Project

The Project: Manufacture a product

- Select a board of directors, chairman of the board, president, or chief executive officer
- Identify product ideas through brainstorming
- Creatively design a marketable product
- Build and test the prototype of the product
- Redesign the product for production after testing
- Prepare advertising for the product utilizing print media and video commercials

- Sell stock in the student enterprise to secure operating funds
- Design jigs and fixtures to be used in manufacturing the product
- Interview and select students for the various jobs in producing the product
- Organize the production flow in the plant
- Conduct a cost analysis of producing the product including such items as labor, energy, materials, transportation, advertising, and capital equipment
- Organize student labor for the production run
- Manufacture the product
- Determine how the product will be packaged
- Identify and select the optimum method of transporting the product to the consumer
- Evaluate the financial success or failure of the enterprise
- Pay the stockholders a stock dividend, if the enterprise makes a profit

In this enterprise, students would use computers and computer controlled equipment as production tools, perhaps some or all of these and more:

- Computer aided drafting (CAD) equipment to plan and design a product
- Robots to move parts of the product from one place to another
- Computer numerical control (CNC) machines to make parts of a product
- Computers to conduct a cost analysis of the product

Conclusion

The new industrial technology curriculum gives teachers an opportunity to make their courses more challenging and more reflective of current practices in industry and technology. When used in conjunction with the enterprise teaching strategy, it provides students with unlimited opportunities to develop critical, creative, problem-solving, and logic skills.

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THINKING THROUGH VOCATIONAL HOME ECONOMICS EDUCATION

Written by Judith Hetherly
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As family needs have changed and business and industry have diversified, the curriculum for vocational home economics education courses in Texas has been regularly updated. Until 1982, subject matter was suggested to school districts; with the implementation of Chapter 75, the essential subject matter of courses was mandated. School districts however, have been encouraged to develop course material beyond the mandate and tailor-make the curriculum for their particular students.

The goal of home economics education is to prepare students to manage the dual role of homemaker and wage earner, giving them sufficient background knowledge to promote wholesome family life and effective employment. Regardless of the specific focus of a particular course, all subject matter stems from a common body of knowledge. The essential elements of home economics courses are a means to broaden this common body of knowledge and develop higher order thinking skills. Traditionally, home economics teachers have done this by providing experiences in which students apply their knowledge and skills to different situations in their lives.

The goal of home economics education is to prepare students to manage the dual role of homemaker and wage earner, giving them sufficient background knowledge to promote wholesome family life and effective employment.

Bloom's Taxonomy of Educational Objectives sequences the thinking skills students should master. For example, knowledge, or subject matter must be understood before students can effectively apply or analyze material. To apply or analyze knowledge, they must know how to interpret what they know. Within the higher levels of cognition, students sharpen their abilities for transferring their knowledge to other situations, vital skills that require mastery of home economics subject matter including individual and family relationships; consumer education; nutrition, food preparation, and service; parenting; family living; apparel construction and design; housing and interior design; child development and care; management; and individual and family health. Teachers must strive to teach the highest levels of cognition: synthesis, the ability to create and design; and evaluation, the ability to assess, rate, and value. If a student knows about nutrition, but does not know how to apply this information, what use is it?

If students must learn to develop their ability to think, teachers must learn how to develop their ability to teach all levels of cognitive skills.

Teaching Techniques

If students must learn how to develop their ability to think, teachers must learn how to develop their ability to teach all levels of cognitive skills. Two important strategies used to achieve these objectives are cooperative learning and debate.

Cooperative Learning

Cooperative learning is a positive approach to a positive outcome. Research indicates that cooperative learning experiences, in contrast to competitive and individualized experiences, promote higher academic achievement and superior cognitive reasoning, greater cross-ethnic interaction and positive cross-ethnic attitudes, and interpersonal attraction between handicapped and nonhandicapped students. *(Johnson & Johnson)*

Debate

Debate, discussed in "Tips and Topics," by Kim Kamin, a home economics professor at Texas Christian University, compels students to sort through information and take a position on an issue. Students must be prepared to respond to solutions or positions, whether serving on the debate panel or as a participatory class member. Debate is a technique that gives all students in the class an opportunity to analyze, synthesize, and evaluate information.

Relevant Curriculum

Today, most adults manage dual roles, balancing school or work with family responsibilities. In a research project entitled, "A Study to Determine the Relationship Between the Workplace and the Home," Ginny Felstehausen found that a person's success in one area is directly related to the other. Based on these findings, the new essential elements for vocational home economics were designed to help today's students learn to balance dual roles. As teachers use both cooperative learning and debate as strategies to teach the curriculum, the goals for student learning could be:

- knowledge of the complexity of home, work, and family life
- knowledge of valued ends; what should be, not what is
- recognition of long-term significance
- recognition of the importance of a proactive stance
- knowledge that relates theory and practice
- recognition of the importance of critical and creative thinking
- knowledge of the process for finding solutions

Achieving Goals

How does a teacher help students achieve such goals? Consider the following unit of study to help students resolve the problem of balancing dual roles.

Sample Unit of Study for Developing Critical Thinking Skills

Unit Objective: Use critical thinking skills to resolve the problem of how to balance work and family responsibilities

Phase One
Identify Responsibilities
Questions to consider through cooperative learning or debate could be: What responsibilities do students have? How much time is required to carry out these responsibilities?

Phase Two
Examine Theory and Performance Rationale
Provide students with information that examines the relationship between work and family performance, clarifies the meaning of values, distinguishes facts from values, and defines value principles.

Phase Three
Demonstrate Performance
Using problem-solving procedures, have students assess the problem, identify jobs to accomplish and adjustments to make in behavior, explore possible corrective measures, and set corrective measures in place.

Phase Four
Evaluate Accomplishments
Give students an opportunity to evaluate accomplishments and communicate either orally or in writing the process used to determine responsibilities, the options that were examined, and the outcome or performance.

Phase Five
Transfer Knowledge To Other Issues
Guide students to identify other problems to be solved. In this learning experience, thinking, the non-verbal mental act, has taken place, and perhaps even metacognition has occurred—students may have thought about their thinking.

Conclusion

The curriculum concept discussed in this article can be used in any home economics course, whether it be nutrition and food preparation, or individual and family health care. Cooperative learning and debate are excellent strategies that involve students in applying their critical thinking skills to problems that are meaningful to them.

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THOUGHTS ACROSS THE STATE

REALISTIC
EDUCATIONAL
ACHIEVEMENT
CAN
HAPPEN

ACCELERATING LEARNING POTENTIAL

Written by Victoria Post
Consultant in Accelerating Learning Potential
Kingwood, Texas

Students can learn one and one-half to five times faster and remember more when taught by accelerated learning methods, according to numerous studies completed the last ten years with students in first grade through graduate school. The research results published in this country by Georgi Lozanov, from the Research Institute of Suggestology in Sofia, Bulgaria, and verified by a team from UNESCO, have challenged United State educators to investigate his methods. *(Rose)*

According to reports in *Superlearning*, students taught foreign languages by the Lozanov method learned five to twenty times faster than in traditional classes, and also retained more of their learning. In fact, six months later, retention was 88 percent or more in some studies. In regular Bulgarian elementary schools, when average students were taught by accelerated learning methods, they appeared to be gifted. All first graders, for example, were reading on third grade level in their native language, all third graders were ready for high school algebra, and no one was failing. Students learned in a month what usually took half a year. *(Ostrander & Schroeder)*

What is Accelerated Learning?

In this country, accelerated learning projects are called Suggestive Accelerative Learning and Teaching (SALT), taught by Donald Schuster at Iowa State University; Learning in New Dimensions (LIND), taught by Charles Schmid of the LIND Institute in San Francisco; The Accelerated Learning Process in Schools (ALPS), taught by John Grassi at Cambridge College; Acquisition Through Creative Teaching (ACT), taught by Lynn Dhority at The University of Massachusetts; and accelerated language classes, taught by Charlotte LeHecka at the University of Houston, among others. The name the Kingwood project has chosen to use is borrowed from the Title IV-C project in the Paradise California Schools, 1981-83, which showed that regular elementary students taught with accelerated learning methods scored one and a half times higher on their California Achievement Tests than control classes. *(Schuster & Gritton)*

Students can learn one and one-half to five times faster and remember more when taught by accelerated learning methods.

The main elements of all accelerated learning programs, illustrated in Figure 1, include a positive-suggestive classroom, with aspects of suggestion similar to advertising, and unusual styles of presenting material to accelerate classroom learning. Physical and mental relaxation exercises, classical music, dramatic presentations, games, and use of the arts in teaching—drawing, singing, story-telling, dancing, moving, acting—are all components of an accelerated learning classroom. An important aspect of an ALPS classroom is the involvement of both right and left hemispheres of the brain in learning to improve retention and recall. The more connections there are between brain cells, the more access there is to stored memory. Robert Ornstein of the University of California found that when the two hemispheres work together, the result is five to ten times more effective than when only one hemisphere is active. *(Buzan)*

Creating A Positive-Suggestive Classroom

Psychology teaches us that a pleasant environment makes students feel better about learning, so ALPS teachers concentrate on making the classroom as physically attractive as possible, as well as psychologically safe and pleasant. ALPS teachers make sure non-verbal and verbal communication are positive and supportive when students are learning, avoiding cutting remarks, shaking their heads from side-to-side, being impatient, sarcastic, or short with a student, and other negative signals. Teachers are authoritarian, yet warm and accepting. They intentionally plan comments and stories that help students believe they have the ability to learn far more than they ever believed they could learn, and that they can learn without working hard. Learning becomes fun and easy, as it was when they were little children, playing games and learning songs.

Relaxing Mind and Body with Music and Exercise

The mind works better when the body is relaxed, not feeling stress or fatigue. ALPS teachers use the slow, stately romantic movements of Bach, Vivaldi, Corelli, Telemann, and others as background music for relaxation. Physiologists found that listening to Baroque classical music, which has about sixty beats per minute, decreases heart rate, breathing, and blood pressure. In the brain, beta waves decrease, and alpha waves increase and become dominant. Physiological research shows this calmed state of the body facilitates mental functioning and learning. The body uses less energy, so there is more for the mind. This particular music induces alert relaxation—alert mind, relaxed body. *(Ostrander & Schroeder)* The LIND Institute has recordings available for purchase that are especially relaxing.

ALPS teachers teach students to relax physically by using progressive relaxation techniques to tense and then relax their bodies, one part at a time, as the relaxing music plays softly in the background. After some practice, students can relax by themselves with just a few prompts

An important aspect of an ALPS classroom is the involvement of both right and left hemispheres of the brain in learning to improve retention and recall.

from the teacher. Sometimes only the music is needed to put students in a state of alert relaxation, receptive to learning quickly and easily. Another relaxation exercise especially good for the mind is to have students picture a beautiful, peaceful place where everything is perfect. If students picture a beach, they are encouraged to use their senses to smell the salt water, feel the sea breezes and sun on their skin, hear the sea gulls, and see waves gently splashing as they hit the shores.

Increasing Retention and Recall with Music

The Lozanov method uses classical, pre-romantic period music from Haydn, Mozart, and Beethoven to accompany a dramatic reading by the teacher of new information to be taught. The teacher reads very slowly and dramatically, the voice rising and falling with the music like one of the instruments in the orchestra, while students read along in the book. This technique is used with foreign language stories, spelling lists, physiology terms used in medical school, and other classes where new vocabulary has to be memorized.

Most of the accelerated learning programs use music more for reviewing information that has already been taught than for introducing new vocabulary, as in the examples mentioned. When reviewing information to help retention and recall, slow Baroque relaxation music is played softly in the background while students close their eyes and listen. The teacher reviews the lesson in an interesting voice, at a normal rate of speed, as students just relax, listen, and see pictures in their minds. When the lesson is over, students remain still for a few minutes, listening to the music, letting their minds process the information. This technique has been found to be successful in almost all subject matter—science terms, geography concepts, math facts, statistics, history review, spelling words, vocabulary for any subject—from first grade through graduate school, whenever there is information to be reviewed. *(Schuster & Gritton)*

Creating A Playful Learning Environment

Children learn by playing before they come to school, and they can also learn better in school in a relaxed environment where it is acceptable to make mistakes. Games to reinforce subject matter take the place of boring drill and repetition. For example, tossing a soft foam rubber ball to the students who are to respond, rather than just calling on them, makes a game out of what could be a stressful drill. Adults and teens in the accelerated language classes at the University of Houston love to play games on the floor with vocabulary cards, race to the charts to be first to get a point for their team, or give the answer when the ball is tossed to them. Learning has become fun.

Puppets, role playing, and playlets to teach concepts add to the enjoyment of learning. Charles Schmid has a puppet that teaches grammar to his college German class students, and another puppet that always lags behind, prompting students to tutor him in what they have learned.

The mind works better when the body is relaxed, not feeling stress or fatigue.

High school students in a summer accelerated German class taught by a University of Houston instructor loved putting on hats to role-play characters in the stories in their German text. They also made up their own play in German using their new vocabulary, and props and hats provided by the teacher.

Dramatic Presentations

When teachers act out new concepts or vocabulary words, they give the students some action to experience to help learn them. Seeing the action gives the students a picture to go with the words, and having a moving picture is better than a still picture for helping retention and recall. When the students also pantomime or act out the words, they are using kinesthetic experiences to help them learn and have fun too. We know that pleasant experiences are easy to remember because they are emotional. *(Schmid)*

Using the Arts to Teach

Emphasizing right hemisphere activities to teach predominantly left hemisphere subject matter involves both hemispheres of the brain in learning, thus increasing the retention and recall of subject matter. ALPS teachers therefore use pictures, art work, singing, dancing, moving, story-telling, and plays to teach subject matter.

We all know we remember things better if we have some rhyme, song, poem, rhythm, or association to remember new information. Rhymes like "Thirty days hath September, April, June, and November," and "In fourteen hundred ninety-two, Columbus sailed the ocean blue," have helped millions of this country's students retain information. Even college students and older adults find these rhymes helpful. ALPS teachers use as many songs, rhymes, and associations as possible to teach subject matter.

Presenting A Global Picture

When students know how new learning fits with what they already know and into the rest of the area of study, the brain can analyze, categorize, make associations, and store information for recall more efficiently. The learning styles of some students also demand that they have the whole picture before they begin learning the parts and where they fit in, so ALPS teachers include the global picture in lesson plans as much as possible.

Using Peripheral Stimuli for Learning

The brain thrives on stimulation and will look for things in the environment to learn about when not being kept busy. Students don't just look at the front of the room where the teacher is; they also look around and notice other things, often unaware that they have noticed them. Teachers can use that natural desire of the brain to be stimulated to help children learn more. Posters, models, collections, pictures,

Children learn by playing before they come to school, and they can also learn better in school in a relaxed environment where it is acceptable to make mistakes.

or charts can be placed in the classroom a week or two before discussion about a topic begins. Often, students will have absorbed new information by the time it is formally presented, making them feel good about what they already know. It is important to provide materials that pique interest, yet do not distract the students.

Regaining the Skill of Imaging

Reading teachers are well aware that today's students do not have the same ability to form images as they read or listen, as did the radio generation. Exercises that help students see pictures in their minds encourage "whole-brain" experiences. Teachers can learn more about imaging in the readings on accelerated learning.

The Future

While the use of ALPS techniques is relatively new in this country, research projects that are currently under way will soon be published and widely disseminated, giving more exposure to these methods and their success. The integration of right and left hemisphere thinking and learning has been shown to greatly improve retention and recall of subject matter. Relaxation music calms the body, allowing the brain to absorb information more easily and create more fluently. The power of positive thinking about our abilities to learn faster and better has been shown to significantly affect student learning. Methods of applying this knowledge to everyday classroom teaching are now being explored and evaluated to disseminate the results to educators interested in increasing retention rate, learning rate, and creativity in our educational system.

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Resource List:

Music tapes may be purchased from the LIND Institute, Box 14487, San Francisco, CA 94114. Audio tapes of lectures on the LIND Method of Accelerated Learning are also available from the same address.

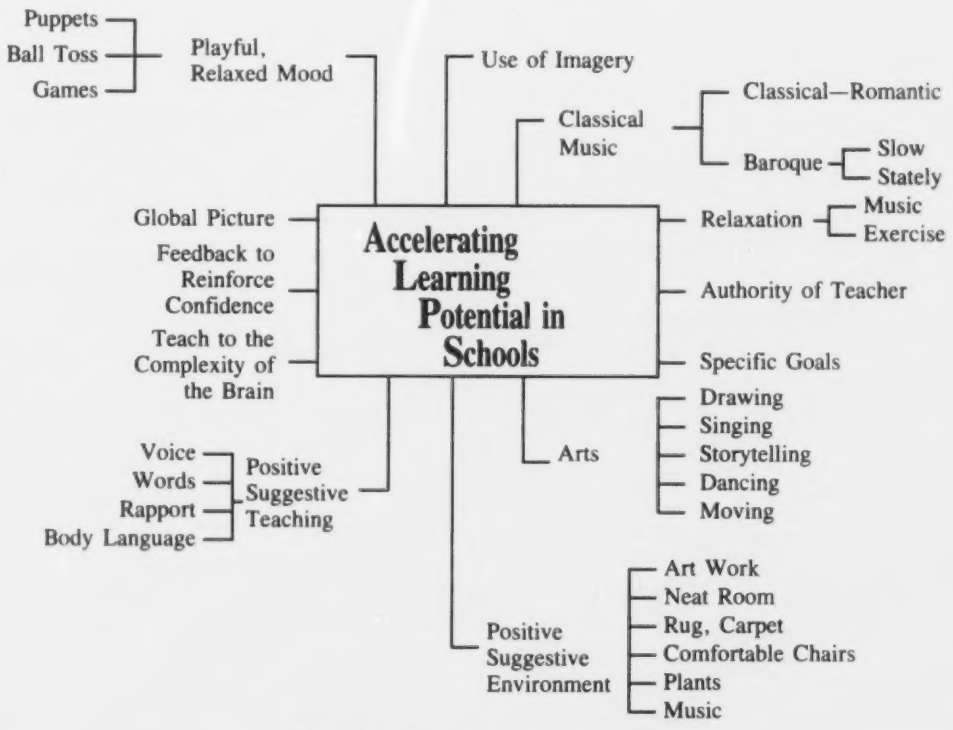
Learning in New Dimensions, 1987. Audio tapes of lectures by Charles Schmid.

Relax With the Classics, 1987. Cassette tapes for classroom relaxation and creativity.

Instructional manuals may be purchased from John Grassi, ALPS Products, 369 Singletary Lane, Framingham, MA 01701.

The Accelerated Learning Process in Science: A Handbook for Teachers, 1985. (activities for teaching science to first, second, sixth, and tenth graders)

Introduction to Geometry: A Curriculum Guide for Elementary Teachers, 1985. (activities for teaching geometry terms and concepts to fifth and sixth graders; also some use in fourth grade)



Mind Map of Elements of Accelerating Learning Potential

Figure 1

A SHORTCUT TO UNDERSTANDING AND TEACHING HIGHER LEVEL THINKING SKILLS

Written by Marilyn Rice
Resource Teacher for Gifted and Talented Students
Richardson ISD

When a teacher decides to meet the needs of not only gifted students, but all students, the discovery of myriad activities, approaches, and thinking models may be bewildering. Yet, a simple and educationally valid approach to synthesizing these ideas, and educating teachers to apply them easily and effectively, was developed and implemented in Richardson ISD in the 1987-88 school year. This article describes a model developed by the author that can be used as a framework for developing educational experiences. It is based on key ideas in gifted education for extending the minds of all pupils, regardless of whether they are in a gifted program. Figure 1 summarizes the framework:

Open-Ended Questions & Activities	**Leading Toward**	**Input Process Output**	**Leading Toward**	**High-Level Generalizations**

FIGURE 1

Arthur Costa says many thinking models have more similarities than differences. They are distinguished by three basic components: input, process, and output.

Arthur Costa, an authority on developing higher level thinking skills, says many thinking models have more similarities than differences. They are distinguished by three basic components: input, process, and output. Figure 2 summarizes a consensus model titled "High Tech Thinking," which shows how the most commonly taught thinking skills models fit into this three-part framework.

High Tech Thinking: A Summary of Thinking Skills Models

Model	Input	Process	Output
BLOOM'S TAXONOMY	Knowledge	Comprehension Application Analysis Synthesis Evaluation	Synthesis Evaluation
PROBLEM SOLVING	Mess Fact Finding	Problem Finding Idea Finding Solution Finding	Solution Finding
SCIENTIFIC METHOD	Observe	Question Infer Hypothesis (Invention) Compare	Conclusion Prediction
CREATIVE THINKING	Gather Information Brainstorm	Brainstorm Incubation Insight	Insight Evaluate
RENZULLI	Type I Exploratory	Type II Process or Group Training	Type III Independent Study
PIAGET	Assimilation	Accommodation	Adaptation
SOI	Cognition	Divergent Convergent Memory	Convergent Evaluation
RESEARCH	Gather Information	Prioritize Organize Synthesize	Synthesize Report
TABA	Observation Recall Reading	Guided Discussion	Concepts Generalizations Application of Generalizations Values

©Marilyn Rice, 1982

FIGURE 2

There are four ways the model promotes effective educational experiences:

- It provides a framework to help teachers develop curriculum.
- It helps students learn how their minds work so they are better able to solve problems, conduct research, or form values, among other processes.
- It helps teachers and students learn and apply current thinking models.
- It provides a "hook" for learners, linking thinking skills models together.

Input—Process—Output

Open-Ended Questions and Activities

When using the High Tech Thinking Model as a framework for developing curriculum, the teacher begins with open-ended questions and activities—those that promote divergent thinking, allowing for many different responses. These questions and activities are a means of reaching input, process, and output. Benefits to students include increased student involvement and, as a result, enhanced self-esteem; and the opportunity for students to stretch themselves by using what they know and are interested in.

Processing Information

To enable students to process information, the teacher should plan questions or activities that cause students to use information, or input, that leads them to understand, and perhaps even express, low and high generalizations.

High-Level Generalizations

The ultimate goal of the framework is the development of high-level generalizations. Some examples are: "The culture under which an individual is reared and the social groups to which he belongs exert great influence on his ways of perceiving, thinking, feeling, and acting," or "Environment affects man's way of life, and man, in turn, modifies his environment." *(California State Control Committee for the Social Sciences)*

Planning Curriculum Around Generalizations

According to Bruner, we learn these generalizations throughout our lifetime at different levels of abstractness. Ideally, the significant learning we do serves to broaden and deepen our understanding of these ideas. By organizing our learning around generalizations, pupils assimilate new information effectively and efficiently, and they are able to apply what they have learned to new situations.

The necessity of organizing curriculum so that students are led toward main ideas was expressed by Gallagher: ". . .The instruction of gifted students should focus on the major ideas, the large generalizations that they have the capability to grasp...It is the large idea, the big truth as we know it that we should be seeking to deliver."

Open-ended questions and activities are aimed at guiding students to discover high-level generalizations referred to as the "structure of the subject matter" by Bruner. The necessity of organizing curriculum so that students are led toward main ideas was expressed by Gallagher: ". . .the instruction of gifted students should focus on the major ideas, the large generalizations that they have the capability to grasp. . .It is the large idea, the big truth as we know it that we should be seeking to deliver."

Bruner states, however, that such planning is important for average students, as well. This structure builds the ability to think abstractly, aids memory, provides additional motivation to learn, and increases the students' ability to transfer information to a new situation, aims emphasized by Piaget, Bruner, Taba, Gallagher, Maker, Renzulli, and others.

Units That Use the High Tech Model

Texas teachers were trained to use this model in an elementary school with extremely mixed ability grouping. The unit that follows, titled *Families*, was developed and demonstrated by the author of the model. The unit titled *Music and Art During the Impressionistic Period* was developed by a teacher who had no prior training in teaching thinking skills, following two 45-minute training sessions.

By altering the manner in which subjects are presented, teachers with numerous subjects can cover required topics while extending the gifts and talents of all students!

Unit Title: Families (Third Grade)

by Marilyn Rice

Generalization: Through all time and in all regions of the world, man has worked to meet common needs and satisfy common desires and aspirations.

Related Generalization	Input	Process	Output
There are different kinds of families in our culture. They all satisfy their needs for clothing, food, and shelter in similar yet different ways.	What is your family like? How does your family solve its basic needs?	Analyze	Children draw pictures about their families on manila paper divided into four sections: family | home clothes | favorite meal
		Analyze Synthesize	Act out, write, or tell about something you have done in your family that made you feel foolish, but now seems funny. Directions to home: Put up a map of community showing where each child lives. Bulletin Board: Have each child plan a bulletin board about self and family schedule for the entire year.
	What kinds of work are done by different members of your family? (May discuss trend of moving from traditional roles in families)	Analyze	Discussion
	What are some things you have learned from your family? (Kinds of food one likes, language, love of music, books, how to treat people)	Analyze Synthesize Evaluate	Discussion

The manner in which a family meets its basic needs is related to its available resources and culture.
To be different is not wrong—just different.
	How are families alike and different?
	
	Why are families alike and different?
			Show filmstrips: Five families on five different days
			
			Have students answer questions on sheets provided
			• Where does family live?
			  • Describe the climate.
			  • Describe the land.
			  • What is the population?
			• What is their home like?
			• What do they eat? How do they get their food?
			• What do they do for fun? Why do they choose these ways to have fun?
			Encourage children to understand reasons for differences.

Organized group life must have some established rules and social controls.	What are some of the rules in your family that you must obey? What are some rules in your school community?...rules (laws) in your state and nation? How are these rules alike and different, in general?	Comprehension Analysis	Discuss Discuss

NOTE: These activities lay the foundation for the year's social studies for third graders at Hamilton Park School. Main ideas of *The Third Planet* were developed so that students would remember and understand them, regardless of their reading and comprehension level. Some of these activities, as well as others not included, were open enough to challenge all students. (Viereck, Phillip. *The Third Planet*, London: The Macmillan Co. © 1971; see also Hand, John S., *Adventures in English*, River Forest, Illinois, Laidlaw Bros. © 1975.)

Unit Title: Music and Art During the Impressionistic Period (Fourth Grade)

by Judi Davis

Generalization: Impressionistic composition or painting gives an artist's impression of a subject.

Related Generalization	Input	Process	Output
There are different ways to express a person's impression of something. The two most recognized ways are through music and art.	What do you find exciting in music and art? What kind of music do you like? What kind of art do you like? What are some of your favorite songs? What kind of musical instrument do you enjoy? Whose life was described? Why was he famous?	Knowledge Analyze Evaluate	Discuss Read "Who Is Leonard Bernstein?" in *Rhymes and Reasons*.
Impressionistic music tells no fact. It uses music and suggestion to describe something. It can be program music that tells about nature, a story, or a scene	What is impressionistic music? Claude Debussy wrote "La Mer." What do the French words "la mer" mean? Have you ever seen an ocean, sea, or large lake? How did it make you feel? Synthesize	Knowledge Knowledge Analyze	Read "What Is Impressionism?" by Leonard Bernstein, in *Rhymes and Reasons*. Students write a short paragraph answering these questions last. Smith, Carl B., Ronald Wardhaugh, *Rhymes and Reasons*. New York: Macmillan, © 1980.
A French Impressionistic painting is blurred and misty. At first sight it is hard to tell what it is. The colors are soft.	Do you like this example of a French Impressionistic painting? Is it easily recognizable? Why or why not?	Knowledge Analyze Evaluate	In a short paragraph students tell why they like or don't like the French Impressionistic painting.
Music and paintings can be alike in that both can be clear and straightforward, suggestive, and impressionistic. Music cannot be realistic like a painting because notes cannot depict something exactly.	How are music and paintings alike and different?	Analyze	Discussion
There is no formula for "good" or "bad" works of art.	Do you think it is possible to enjoy art that is not easily recognizable?	Analyze	Study the painting by Claude Monet called "La Seine a Lavacourt."
Most people respond favorably to the visual beauty of the Impressionistic painters.	Look at Monet's painting. What kind of day do you think it is? Why do you think so? How would you describe the landscape utilizing the Impressionistic style of painting?		Students go outside and make landscape sketches. Then they make a painting from their sketches. The following directions are to be given for the paintings: • Rub water over your paper with a sponge. • Work over this with brushes filled with colors. • Let the colors flow and run and mix in exciting combinations. • Dampen only part of the paper and then add your colors.

Teaching the Model

When teaching the model itself, so-called "high tech" terminology works well with students who generally are knowledgeable about the manner in which computers process data. Comparing the computer with the manner in which their minds process data helps them be more aware of how their minds work, and how they might think more effectively. Students using the model learn to understand the importance of high quality input to work with or process. This challenges them to continually work on their awareness skills, as well as question sources from which they gather information.

The processing of information, or the second part of the computer model, may be explained as either recognizing relationships between ideas, or breaking ideas into their component parts. The relationships may be cause-and-effect, analogous, or between specifics and generalizations. Processing leads to output, which may be a conclusion, a new concept, or a tangible product. The quality of the output is dependent upon the quality of the other two phases—how thoroughly students process challenging questions and activities.

Summary

The High Tech Thinking Model is a valid addition to any educational efforts designed to lead students toward higher level thinking skills. It offers a procedure that can be used in many different situations, a beginning for learning many thinking models and can also serve as a scope and sequence for program development. Above all, it is quick and easy for teachers and students to use, making learning efficient, effective, and enjoyable. By altering the manner in which subjects are presented, teachers with numerous subjects can cover required topics while extending the gifts and talents of all students!

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DEVELOPING THINKING THROUGH PROBLEM-SOLVING PROGRAMS

Written by Ethel Forte, Tom Priem, and Chris Funderburgh
State Directors of Texas Future Problem-Solving Program

Today's students will live most of their lives in the 21st century. As society changes more quickly than ever before, educators face the awesome burden of preparing today's students for tomorrow's uncertainties. The Texas Future Problem-Solving Program (FPSP) can help provide the tool: problem-solving skills.

In the program, students in grades 4-12 develop problem-solving skills, creative-thinking skills, and verbal and written competencies. It also provides students with a unique opportunity to explore exciting futuristic topics. Students in grades K-3 begin to develop problem-solving and creative-thinking skills by working through present-day problems these youngsters must often resolve.

Program History

In 1974, Paul Torrance, recognized internationally for his work in creativity and gifted education, began working with high school students to address two of his foremost concerns: the decline of creativity among Americans and lack of interest in the future. Combining the creative problem-solving process developed by Alex Osborn and Sidney Parnes with potential problems of the future, Torrance launched what has become one of the largest national programs for capable students.

Today an estimated 150,000 students in all 50 states and several foreign countries use the program materials. The Texas program, now the largest in the United States, was introduced by the Austin Independent School District in 1980 and receives annual funding from the Texas Education Agency to expand the program.

In the program, students. . .develop problem-solving skills, creative-thinking skills, and verbal and written competencies. It also provides students with a unique opportunity to explore exciting futuristic topics.

Program Goals

The Future Problem-Solving Program is designed to motivate students to:

- Develop creative thinking
- Increase awareness of and interest in the future
- Improve oral and written communication skills
- Learn and use problem-solving strategies

In 1974, Paul Torrance. . . began working with high school students to address two of his foremost concerns: the decline of creativity among Americans and lack of interest in the future.

- Develop and improve research techniques
- Develop critical and analytical thinking skills
- Develop teamwork skills

Program Description

Future Problem Solving provides a structure in which students can imaginatively explore possible futures. In grades 4 through 6, students participate in the junior division; in grades 7 through 9, the intermediate division; and in grades 10 through 12, the senior division. Working in teams of four, students research topics that will affect future American society and the world. Topics in recent years have included endangered species, world hunger, the American legal system, changing family structures, illiteracy, the elderly, and space travel. Students investigate three topics each year, preparing three problems. The program is interdisciplinary and can be incorporated into any subject or elective course in creative problem-solving.

Before problem solving begins, students research their topic, obtaining information from *The Reader's Guide*, various periodicals, current newspaper and magazine articles, authorities on a given topic, and a myriad of other sources. Students often use the program's *Resource Manual*, an extensively annotated bibliography on each year's topics.

Future Problem Solving requires far more than memorizing large quantities of information. A major program strength is developing critical and analytical thinking skills as students use their research to confront real-life problems. A "fuzzy situation," which projects the topic into the future and describes conditions that may exist at that time, sets the stage for each of three practice problems. Students learn fluency, flexibility, originality, and elaboration techniques to enhance their responses in the creative problem-solving process illustrated in this article. In **step one, *Brainstorm Possible Problems,*** each team brainstorms and describes as many as 20 possible problems related to the topic. Based on their research, students predict future trends, then identify possible problems and their relevance to the fuzzy situation.

From the 20 possible problems generated by each team, the students select what they consider to be the most significant underlying problem for creative attack in **step two, *Identify an Underlying Problem.*** Again, the students draw heavily on their research as they weigh the significance of each possible problem.

After describing the underlying problem they intend to solve, the students brainstorm 20 alternative solutions in **step three, *Brainstorm Alternative Solutions.*** Solution finding involves the thinking skills of analysis, evaluation, and synthesis when students extend present information to produce something new. It also involves the creative

capacity to go beyond present knowledge to see facts or pieces of information in new or unusual ways. Through elaboration of their ideas, students establish the relevance of the solutions.

To analyze 10 solutions that the team considers best, the students establish criteria for comparing and evaluating their ideas in **step four, *Choosing Criteria for Evaluating Alternative Solutions.*** Through a ranking procedure in **step five, *Evaluate Alternative Solutions,*** they assess solutions according to their criteria to determine which one will be the most promising.

The **sixth step** of the problem-solving process, ***Describe the Best Solution,*** involves describing this solution in greater detail and justifying it as the most promising. Students develop a plan for implementing the best solution, then consider the following questions to determine what is needed to make the proposed solution a reality: What stages will be involved in the implementation of the most promising solution? What time elements are involved? How long? When? Who will take responsibility for part or all of the implementation? How will you gain support for the solution? How will be the solution be funded? What obstacles might you encounter? How might you avoid the obstacles or respond to them? Are alternatives or back-up plans built into the plan in case part of the solution fails? How will you evaluate progress toward solving the problem?

Other Program Components

- **State and International Competitions**
  Each spring, teams of problem solvers who placed in the top 10 percent of their division in the third and last practice problem meet in Austin for three days of competitive problem solving and educational seminars at the State Bowl, co-sponsored by the University of Texas College of Education. Teams develop solutions to a new problem and compete for plaques and certificates. They also share their ideas with their fellow problem solvers by performing skits in which they "sell" their best solutions. The three winning teams, one from each division, with the highest scoring problem-solving booklets advance to the international competition.

  At the International Future Problem-Solving Conference, representatives from all over the United States and Canada convene. Competition is again an aspect of the conference, but the emphasis is placed on meeting new people and sharing ideas.

- **Community Problem Solving**
  Begun in Texas, and now part of the national program, Community Problem Solving gives teams an opportunity to apply their creative problem-solving skills to real-life problems that the teams identify in their schools, communities, the state, or the world. Projects are evaluated by a panel of business people and educators.

Future Problem Solving requires far more than memorizing large quantities of information. A major program strength is developing critical and analytical thinking skills as students use their research to confront real-life problems.

- **Scenario Writing**
  This component of Future Problem Solving is an individual, rather than team effort. Problem solvers project themselves at least 20 years into the future and examine what effects their team's solution has had on society. The problem solver presents the situation in a creatively written story set in the future; judges select the best written scenarios and winners advance to international competition.

- **Non-competitive Problem Solving**
  The optional method of scoring practice problems from Future Problem Solving teams is unique to Texas. Teams may receive assistance in problem solving and feedback on their work without receiving a score or ranking. This system has proven to be particularly effective for new or junior division teams that want positive suggestions but are not yet ready to have their work judged.

- **Primary Problem-Solving Division**
  This non-competitive division for students in kindergarten through grade 3 emphasizes a few key components of the creative problem-solving process, primarily brainstorming and evaluating solutions. Teams in this division receive feedback from an evaluator but do not receive competitive scores. Samples of the students' work are published in *Primarily Yours*, the Texas program's newsletter.

- **Future Problem-Solving Summer Coaching Conference**
  A summer training conference held in Austin helps prospective and experienced coaches. Sessions include training for new coaches or coaching strategy and evaluation for experienced coaches. Experts speak on the topics chosen for the coming year's practice problems. The conference also hosts the Mock FPSP Bowl and Primary Simulation, in which coaches complete the first three steps of the problem-solving process. Coaches are placed in teams of four and given a timed period to work through a sample problem. Team booklets are evaluated after the conference. In this way, coaches learn more about the problem-solving process, the timing for competitions, and the evaluation process.

Benefits to Students

In early 1987, the Texas program office received letters from students about their experiences with the three practice problems or State Bowl. Since new coaches often ask about student perspective, a few excerpts follow:

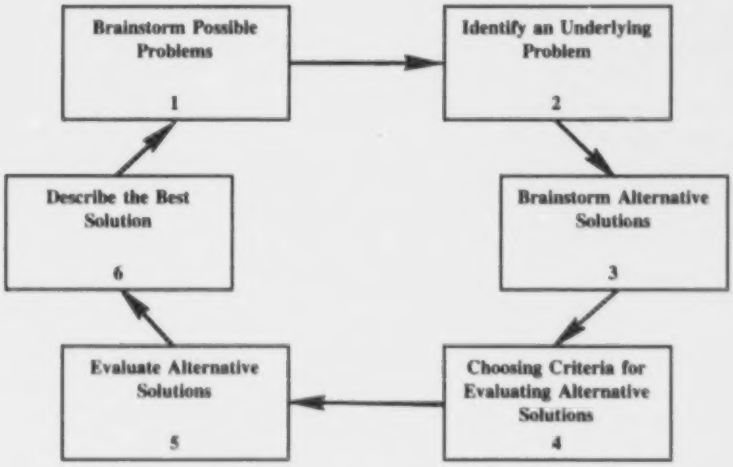
- "Before I joined FPSP, I really bossed people around. After I joined the program, I learned I had to work with my team if we were going to win."
- "I've learned so much, not only about the topics we deal with, but with two hours to complete a task at the State Bowl, I've learned teamwork and communication skills that can easily be applied to other things. Most importantly, I've come to understand that winning is not always important in a competition like this. The feeling of doing your best in a pressure situation outweighs any judgments that an evaluator can make—good or bad."

Solution finding involves the thinking skills of analysis, evaluation, and synthesis when students extend present information to produce something new. It also involves the creative capacity to go beyond present knowledge to see facts or pieces of information in new or unusual ways.

Participation

Teachers may register for full participation in FPSP or the primary division, community problem-solving, scenario writing, or the materials only option. Teachers can request training through their regional education service centers. FPSP staff members will travel to school districts willing to make training sessions available to all coaches within the region. For further information about the Texas Future Problem-Solving Program, call (512) 447-0529, or write to the program at Pleasant Hill Annex, 305 North Bluff Drive, Austin, Texas 78745.

Creative Problem-Solving Process



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PRINCIPALS: TAKING THE LEAD IN THINKING SKILLS

Written by Cathy Collins
Associate Professor, School of Education
Texas Christian University

Without question, the impact of TEAMS on Texas Schools has been extensive and pervasive. In many schools, students receive prolonged drill and practice exercises to prepare for the tests. In other schools, time and money have been invested in curriculum development and staff training to increase the number of worksheets related to single TEAMS objectives. Not only have these activities increased the competitive environment of schools, they have also changed their educational priorities. In some instances, it appears that a climate has evolved wherein good education is equated with extended periods of time that administrators provide for teachers to "practice for the TEAMS."

An alternative is to spend time developing students' high level thinking abilities. By the time high level thinking tasks are completed, TEAMS competencies will have been reinforced in three ways.

First, during the process students will be required to select the TEAMS competencies needed for higher level tasks. This selection process, which is not used in worksheet practice sessions, must be used when the TEAMS test is administered. Thus, higher level thinking tasks allow students to practice the types of thinking that are needed in TEAMS testing sessions.

In some instances, it appears that a climate has evolved wherein good education is equated with extended periods of time that administrators provide for teachers to 'practice for the TEAMS.' An alternative is to spend time developing students' high level thinking abilities.

Secondly, because higher level thinking tasks require the integration and application of separate TEAMS competencies, students will retain more of these competencies. As psychologists are becoming increasingly aware, the strength of one's memory is highly correlated to the intensity of a learning experience. The more valued a skill, the more closely the initial learning experience is tied to a created end-product the more rapidly a person is able to connect new skills to complete a procedure or thinking process, and the more rapidly these skills become automatic and permanent.

Thirdly, in higher level thinking tasks the TEAMS competencies become the tools for work—a vehicle for conceptual thinking rather than separate, unpurposeful skills to be memorized. Therefore, both

You can either identify which...teacher training programs best match the needs of your school and your leadership style, or describe all six programs to your faculty and let them select a plan.

teacher and students view TEAMS practice as an opportunity to explore the transfer of new skills to other school tasks.

As recent studies suggest, however, this approach will not be as effective, or even possible on many campuses, if school administrators are not involved. Kneedler found that administrators must be directly involved in the instruction of higher level thinking, but few have been trained to do so. The purpose of this article is to enhance the ability of administrators to:

- Lead students to higher levels of thinking
- Increase the number of students who master all TEAMS objectives

Administrators must lead the program for advancing higher level thinking in four specific ways:

- Develop a training program for their teachers
- Support teachers as they modify teaching strategies
- Evaluate students on their increased thinking abilities
- Evaluate teachers on their ability to teach thinking skills

However, because administrators generally have received limited training in thinking development, and because their leadership is crucial, this article also serves a second purpose: It provides a means for administrators to increase their own knowledge of the methods that most reliably strengthen students' thinking abilities.

Guiding the Teacher Training Program In Your School

STEP 1 Match the Training Program to Your Needs

You can either identify which of the following teacher training programs best match the needs of your school and your leadership style, or describe all six programs to your faculty and let them select a plan.

Method 1: The "Let Me Tell You What I Need" Method
This staff development program is particularly effective when teachers have many pressures and demands on their time. If they feel thwarted by their attempts to teach thinking skills, this method can increase their commitment to higher level thinking and change their teaching styles. With this program, faculty raise their level of concern and begin to use new strategies more rapidly than with other methods described subsequently.

If you decide to follow this training plan, open a faculty meeting by asking teachers to form small groups. These groups will discuss and agree on answers to the following questions:

- Why should we spend time learning how to increase our students' higher level thinking abilities?
- What proportion of instructional time should we spend developing these abilities?
- Which thinking skills beyond or within the TEAMS objectives do we want evaluated?
- How do we want to be evaluated?
- What resources do we need from the principal?

After groups present their answers to you and other faculty members, the entire group votes on priorities they wish to pursue, collectively and individually, in the coming year.

Method 2: "The Needs of Our Students Will Determine the Year's Faculty Training Sessions" Method

If you select this plan, you take the initiative at a faculty meeting—advancing student thinking abilities is your priority. Then you propose that teachers informally assess their students for a month, using a set of questions generated at the faculty meeting. These questions represent the goals the faculty seek to accomplish by year's end. You begin the list by suggesting these questions about their students:

- Do they initiate appropriate problem-solving behavior in class? How many students do?
- Do they strive to increase their motivation, accuracy, and precision in written work and oral discussion?
- Do they spontaneously apply the 22 objectives from the TEAMS test to subject matter?
- Do they apply higher level thinking skills in new situations?
- Are they creative thinkers, unafraid to work hard to prove their viewpoint, yet willing to modify their innovative ideas in light of new evidence?

When the list is complete, and the first month's assessment has been made, you meet again to select training activities that will satisfy the needs identified in the assessment process. This method of staff development works exceptionally well in situations where scores on TEAMS tests are significantly below staff expectations and where students have not had strong environmental support to develop their higher level thinking skills. *(Collins)*

Method 3: The "Tell Me What To Do and I'll Do It" Method

In this program, you, or the faculty, or both, select specific topics and invite consultants from universities and governmental agencies to conduct training. Setting higher level thinking skills development as a major priority for the year, you tell the faculty you will strongly support their training choices. To start the discussion, you suggest these topics:

Materials for Inservice Training, Faculty Meetings, or Private Faculty Conferences

These training materials are available at little or no cost:

Printed Materials

"Idea Sheets for Teaching Critical Thinking," Peter Kneedler, History-Social Science Consultant, California Assessment Program, California Department of Education, 721 Capitol Mall, P.O. Box 944272, Sacramento, CA 94244-2720

"Teaching Thinking in Our Schools," April 1988 Issue, Educational Leadership Association for Supervision and Curriculum Development, 125 North West Street, Alexandria, VA 22314-2798

"The Six Basic Lesson Plan Formats That Help Teachers Lead Students to Six Types of Thinking," Educational Research Dissemination, P.O. Box 161354, Forth Worth, TX 76161

"Think About It: A Collection of Articles on Higher Order Thinking Skills," Texas Education Agency, 1701 North Congress Avenue, Austin, TX 78701

Videotapes

"Improving the Quality of Students' Thinking," Association for Supervision and Curriculum Development, 125 North West Street, Alexandria, VA 22314-2798

"Demonstration Teaching of Eleventh Grade Students' First Lessons in Strengthening Thinking Skills," Educational Research Dissemination, P.O. Box 161354, Fort Worth, TX 76161

Audiotapes

"Evaluating Thinking" (a four-part series), Association for Supervision and Curriculum Development, 125 North West Street, Alexandria, VA 22314-2798

"Teaching for Intelligent Behavior," Association for Supervision and Curriculum Development, 125 North West Street, Alexandria, VA 22314-2798

Filmstrip with Audio Cassette

"Put Some Thinking in Your Classroom," Benefic Press, 1900 West Narragansett, Chicago, IL 60639

- Teaching the six types of lesson plans that develop higher level thinking abilities (see resource section)
- Teaching higher level thinking skills as an extension of TEAMS objectives
- Using cooperative learning, author's chair, inquiry, and creative problem-solving strategies

This type of program works well in situations where, in your opinion, the staff does not see the need to advance student thinking as vividly as you do. The process is based on a technique used in business and counselling to ensure ownership of a program. This method also produces the greatest number of individual skills in large faculties; among faculty who have not worked together previously, perhaps in a new school; or with faculty who are less vocal.

Method 4: The "I Like the Cafeteria" Method

With this staff development program, teachers design their own personalized plan for professional growth. *(Strickland)* As you discuss the need to improve instruction at all grades in higher level thinking, you specify that teachers can select an option that suits their individual needs. The options you have already arranged for could include:

- Providing one day's release time to attend a professional conference in teaching higher order skills and allowing time in faculty meetings for teachers to demonstrate how they are using these strategies in classes
- Allocating funds for individual teachers to plan an activity or purchase materials for higher level thinking
- Scheduling classes so that teachers can plan, observe, and coach each other for one month. Each pair makes a videotape of two lessons that is shown to the rest of the faculty.
- Inviting the most outstanding teacher of thinking skills within visiting distance to demonstrate lessons. Teachers have the option of attending the workshop or watching it on videotape and writing a report of information gained. Teachers use at least one method in their class and share results at the next faculty meeting.

This method works well for teachers who enjoy working alone, studying issues and organizing their own classroom curriculum. When the following three conditions are present, this plan also affords the most creative adaptations of thinking skill instruction in your school. These are:

- Teachers share results from the professional development option they selected
- They demonstrate increased skills in targeted areas as part of their evaluation

In this program, you, or the faculty, or both, select specific topics and invite consultants from universities and governmental agencies to conduct training.

- The principal also participates in the program. *(Collins)* The goals you set for yourself, however, must benefit all teachers. For example, you might work on a report of thinking skill improvement to give to parents, or design a school-wide activity in which students advance their thinking skills and produce a tangible end-of-year contribution to the community.

Method 5: The "You Scratch My Back and I'll Scratch Yours" Method

If you follow this staff development plan, you begin by asking teachers to describe their higher priorities for the coming year. You also ask them to specify how you can help them reach their goals. Encourage them to give examples of problems they want to overcome, such as:

- Handling their paperwork more efficiently
- Developing more challenging lessons for their students
- Studying ways they can help students eliminate unruly behavior
- Reducing the number of papers to grade at home without decreasing the quality of student feedback

You pledge to help them and ask them to help you. You state your objectives for advancing thinking skills and TEAMS test scores in the coming year. Including talents and information teachers have identified to achieve these goals, you develop a plan in which each teacher has a clear role in advancing student thinking abilities. This type of training program works exceptionally well for faculty with a wide array of talents or with those who enjoy team teaching. *(Russell and Collins)* It also works well in groups in which you are the newcomer by advancing your credibility and building group rapport.

Method 6: The "Let's Start From Scratch" Method

This staff development approach begins by creating a curriculum for developing higher level thinking. Pairs of teachers are given the responsibility to develop, field-test, and demonstrate an activity related to one of the higher level TEAMS objectives in which the campus performed least well in previous years. They then develop different applications of these strategies for other subjects. Next, they present their work to other teachers at faculty meetings. Before the end of the school year, each faculty member must use two of the methods they learned in these demonstrations. The finished curriculum guide includes descriptions of each demonstrations.

'With this staff development program, teachers design their own personalized plan for professional growth.'

B. Strickland

STEP 2 Begin the Instructional Program

By closing the first faculty meeting with a statement that encourages teachers to contact you prior to the next faculty meeting, you strengthen their motivation to increase their students' higher level thinking skills.

If you follow this staff development plan, you begin by asking teachers to describe their higher priorities for the coming year.

They know you are aware of the difficulties associated with learning new skills; therefore, you encourage them by:

- Setting a time each day or week to meet with them individually
- Extending an open-door policy
- Scheduling 15 minute meetings with each teacher to share their problems and ideas

STEP 3 **Report on Progress**

At the next faculty meeting, you outline progress, problems, and the schedule for remaining faculty meetings. The schedule allocates the amount of time to be spent in specific teacher training activities.

STEP 4 **Tie Higher Level Thinking to Teacher Evaluation**

At the second or third faculty meeting, state how the training program will act as a companion to the Texas Teacher Appraisal Instrument. Suggestions for making this connection appear in the third section of this article. Now that the staff development method has been selected, you can begin obtaining resources to help you monitor implementation. Several sources appropriate for any of these methods are listed on page 139.

Supporting the Thinking Skills Program

You assist the instructional program by providing emotional support, fiscal resources, and direct instructional leadership.

Emotional Support

There are three types of emotional support most teachers need:

- **Frequent Feedback**
  Teachers receive tremendous benefits from regular, ongoing feedback. For example, you tell them of specific incidents where you have seen the effects of their instruction—effects they are not able to see as clearly as you do. The faculty will be putting forth exceptional effort in learning new teaching methods. By helping them see the results of their work you motivate them to continue growing.

- **Time to Develop Skills**
  You ensure ample time for growth. You support your teachers by allowing time to develop specific teaching skills and providing guidance to improve "less than perfect" first attempts.

- **Permission to Make Mistakes**
  You show your sincerity in specific ways: You praise individual teachers in front of their peers and applaud the effects on student performance of the whole group; you assure teachers, prior to observing their classes, that you understand the different criteria for observing thinking skills teaching. Such comments free teachers not only to experiment with higher level teaching strategies while you are in the room, but to ask for your suggestions for improvement.

Fiscal Resources Support

You support high level thinking instruction with ample funding. Tell faculty the exact amount you have allocated, the type of resources the funds can buy, and who will make the disbursement decisions.

Direct Instructional Leadership

As you begin to plan ways in which you can provide the best direct instructional leadership, think of the best instructional leaders you know! In you opinion, what do they do that is so effective? Costa, in Brandt's article in *Educational Leadership,* identifies several characteristics:

- Strong administrators have taught at least one lesson in higher level thinking. You could perhaps set aside 50 minutes this week to plan a lesson and another period to instruct a group of students. As an added benefit to your faculty, videotape this experience and allow them to discuss it at the next faculty meeting.
- Strong administrators model higher level thinking. They respond to questions with questions, seeking their staff's and students' thinking on matters. Be explicit about modeling. For example, in an announcement over the public address system, state that you want their ideas on problems, issues, or topics because this is a method to help them think on higher levels. Teachers and students will begin to do the same with each other.
- Strong administrators provide written materials that describe the types of instructional activities they expect to see in their classrooms. The following chart is a start to providing this type of material; your staff can research it and select strategies. The chart describes:
  - Teacher behaviors related to TEAMS higher level thinking objectives
  - Sample behaviors that demonstrate student skill in higher level thinking.

This staff development approach begins by creating a curriculum for developing higher level thinking.

Classroom Activities That Engage Higher Level Thinking

	Teacher Behaviors	Student Behaviors
1.	Help students learn to ask questions.	Work in small groups to solve real problems.
2.	Allow students to structure, order, and assess information without your explicit instructions.	Discuss current issues and complex content problems in hallways.
3.	Extend a basic skills lesson by presenting a subtle case where students must apply more than one skill to arrive at an answer.	Estimate the answer to a problem before they work it.
4.	Draw diagrams frequently to illustrate the thinking process.	Make statements in class to indicate that they are identifying reasons, alternatives, consequences, hypotheses, assumptions, and implications of the content as it applies to real walks of life.
5.	Ask questions that guide students to see a pattern in the information. Follow these questions with a challenge: Can they identify the thinking pattern and solve a simpler related problem using it?	Cultivate interest in a topic and ideas, and spend long periods of time exploring their own original ideas.
6.	Concentrate on the indepth transfer of concepts to new material and content and spend less time on low level thinking, rote memory of factual materials.	Initiate the use of calculators to check their work.
7.	Stress inference at the end of each lesson.	Judge the credibility of sources.
8.	Include lower level TEAMS objectives in most lessons but do not permit them to dominate lessons. You frequently state that you expect your students to use a wide array of thinking skills during lessons.	Volunteer evidence for a conclusion and see similarities that are not superficially apparent.

Classroom Activities That Engage Higher Level Thinking

continued

	Teacher Behaviors	Student Behaviors
9.	Let students do the hard thinking—not you. Don't, for example, tell them how to organize and structure a writing assignment. They make organizational decisions and check them with you before they begin.	Initiate these learning methods in small groups: • reciprocal study—not shared assignments—so that students add to the knowledge of their partners. • consensus seeking—not voting for plurality • devil's advocate techniques—to obtain more objective solutions to problems • debates • think alouds
10.	Determine student misconceptions by asking them what they were thinking that led to their answers. You ask in such a way that they must use precise language to describe their thinking using terms related to the subject. You tell them you do not expect them to always be correct. You teach them how to handle misconceptions later in life.	Make decisions and ask for your evaluation to verify that their thinking was correct.
11.	Frequently ask for points of clarification in discussions. You ask: What do you mean by...? What is an example of the point you are trying to make? What is not an example but close to being one? Would you say something more about...?	Exhibit attitudes of: drive for accuracy, fair mindedness, and objective, active listening to opposite viewpoints.
12.	Teach students to identify barriers that interfere with their talents, projects, or goals.	Use power, influence, and authority appropriately.
13.	Teach them how to work effectively in groups and to use creative and innovative thinking processes such as substitution, modification, renaming, reordering, magnifying, taking calculated risks, mediating, and revising.	Adhere to standards of behavior believed to be important to the school.
14.	Set challenging performance goals with the class and teach them how to use their talents and participate more in group settings.	Set personal priorities and complete work in a well-organized manner.

You assist the instructional program by providing emotional support, fiscal resources, and direct instructional leadership.

Evaluating the Program

By assessing students' oral interaction and writing skills, you can quantify assessment. Pre- to post-test results in effective instructional programs should reveal the following:

Assessing Students in Class Discussion

To assess oral demonstrations of high level thinking, you can construct a classroom interaction instrument or use research format. *(Collins)* To begin, you attend a class prior to implementing new strategies and again the following spring. Through an analysis of questions such as the number of times students extend discussion without teacher intervention and the quality of students responses, you can quantify the amount of growth that has occurred. To illustrate, by the end of the school year:

- The number of questions that ask for recall of isolated facts should be reduced by 50%
- Students should ask more questions. These questions ask for clarification about similarities that exist between the information being presented and their existing knowledge.
- By April, students should frequently ask "why" and "how" questions during class. These questions demonstrate they are following the teacher's direction of thought.
- Students should be able to discuss the thought process they used to arrive at an answer.
- Students should also begin to examine issues in their personal lives, communicate with less jargon, and volunteer more information in class that they researched without being asked to do so.
- Students will also have learned more about their own capabilities that they had not expressed previously. For example, they will comment that they are learning that "our problems seem less complicated now that we know problem-solving techniques," or "I learned to make decisions instead of beating around the bush."

Assessing Student Writing Samples

You ask a class to prepare an analysis of a literary work and explain their response. If the writing sample contains statements that characterize the following thought processes, you have evidence that the program has been successful:

- Students clarify their position by comparing and contrasting features from the literary piece.
- They indicate that they understand the relationship between literal and inferential aspects of the work.
- They make statements to demonstrate their awareness of the basic position presented, the purpose of the writing, the shape of the argument, and structure of the plot.

- Their viewpoint differs somewhat from the author's viewpoint.
- They either take exception to some aspect of the work or specify why they lend total support to all points.
- The structure of their writing uses appropriate subordinate or superordinate divisions, and the steps in their thinking are explicit, as well as effective.
- They make relevant distinctions.

Changes in student behavior will be diverse and not easily assessed and, unfortunately, tests that assess specific changes in thinking are still being developed. Meanwhile, case study reports, anecdotal records, and records of the number of times students apply their thinking in new situations are appropriate indicators of success. How many times do students mention the thinking skills they learned earlier? Do they persevere more consistently than at the beginning of the year? Do they check for accuracy without being told to do so? Do they try novel but probable solutions to problems? Such evidence can assist students, teachers, and parents to better appreciate the work being accomplished.

Assessing Teachers

As stated earlier, how well teachers have advanced their abilities to teach thinking skills should be assessed in their annual evaluation. In addition, you can institute a reward program that will increase teacher ownership and investment in their own improvement. In a successful program, you can expect teachers to be using higher level thoughts as they select, implement, and test their instruction. As Brandt illustrated, teachers should begin to choose topics, not only because they are important to the subject but because they cause students to use higher level thought processes.

A history teacher, for example, chooses to spend more time studying the Declaration of Independence than the Gettysburg Address because the former provides greater opportunities to engage students in higher level tasks. As they study the Declaration of Independence, they could be asked to:

- Identify the reference documents used in constructing the first draft, determine why each was used, which parts were included in the final document, and why
- Outline differences in viewpoints that existed among the writers and study how these differences were resolved
- Increase students' understanding of how differing viewpoints can affect their own groups.

Before you begin to assess teachers, you may want to ask the staff where they have grown most in the evaluation instrument. If you prefer, you can make this decision yourself and tell them which areas on the

. . .you assure teachers, prior to observing their classes, that you understand the different criteria for observing thinking skills teaching.

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Texas Teacher Appraisal System Observation/Evaluation Record you anticipate changes to have occurred. The areas in which most change should occur follow:

Division I

1. Provides opportunities for students to participate actively and successfully
2. Evaluates and provides feedback on student progress, not only on subject matter but on the thinking processes taught

Division III

6. Instructs for cognitive, affective, or psychological learning and transfer to higher order skills

Division V

13. Promotes and evaluates student growth in higher level thinking skills by planning new types of instruction, learning new teaching strategies, and creating progress reports for students about their increased thinking abilities

Summary

By following these four basic steps, within one year you can dramatically influence your instructional program and begin to change your students' lives. Which of the six methods of teacher training are best for your school—and why?

TEACHING SLOWER LEARNERS HIGHER LEVEL THINKING

Written by Carol Marshall
Education Director, The Center for Slower Learners
Richardson, Texas

Why do Small Group Techniques Work With Slower Learners—and ALL students?

One of the best ways to teach slower learners--students with IQ's of 70-89—higher level thinking skills is through small classroom groups. Some reasons are:

- These students are included in active, task-focused learning, rather than being excluded from the competition. Students who cannot compete singly become group members—part of a team.
- They benefit from exposure to language and thought modeled by more able learners.
- They learn there are alternative ways of looking at things, of answering questions. They begin to realize that there isn't just one right answer, and that "only the teacher and the smart students know what it is!"
- They gain confidence, risking thoughts or ideas in the small group, when they would rarely risk failure before the teacher and entire class.
- Once they feel part of the group, they risk showing themselves and their personalities in a way that isn't disruptive but is cooperative. And they often provide an interesting perspective or viewpoint that earns the respect and acceptance of more able learners.
- They respond with positive results in attitudes, behaviors, and grades when factors in their learning styles or strengths are matched to classroom conditions.
- Because they fit in, they relax—two critical readiness factors for successful learning. In essence, slower learners learn with and from their peers much more naturally and successfully than they learn by themselves or from a teacher in a large group setting. *(Dunn)*

'In essence, slower learners learn with and from their peers much more naturally and successfully than they learn by themselves or from a teacher in a large group setting.'

R. Dunn

Why Don't Large Group Techniques Work With Slow Learners?

In a large group setting, the teacher is usually the dominant figure, presenting information verbally and visually, lecturing, asking ques-

Team learning is an effective technique for introducing new material to students within small groups. The teacher determines assignments.

tions, leading discussions, assigning seatwork, and maintaining discipline.

This model is not only an energy drain on the teacher, but it requires certain characteristics of the learner. To be successful, students must be motivated, persistent, responsible, structured, and learn well alone through auditory and visual channels. Slower learners rarely possess these prerequisite learner characteristics.

In a setting like this, the deck is stacked against slower learners because the classroom is competitive by design. Clearly visible are the motivated, brightest, and fastest learners, and the teacher's positive response to them is obvious to students who do not learn quickly. It discourages and often excludes slower learners from active participation, leaving them feeling distinctly inferior.

Slower learners are not slow in recognizing their place in the competition. They often respond with negative behaviors that reflect all shades of "fight or flight," colored by such factors as personality and tolerance of stress. Teachers can quickly name these behaviors: "She doesn't try; he's a clown; he argues over everything; she's a loner—not motivated, not persistent, not responsible; he daydreams. . . ."

How do You Manage Small Groups?

The class could be sorted into groups of five to eight students by drawing numbers or different slips of colored paper or cards from a box, for example. Any method is acceptable as long as there is a mixture of student abilities in each group.

A recorder is selected to write group responses to questions. The teacher can assign a recorder for each group or select them randomly, perhaps using this ice-breaker: "The recorder in your group will be the person. . . who got up the earliest this morning. . . who has a birthday closest to today. . . who has the smallest hands. . . who is wearing the darkest clothes. . . ." Having a recorder relieves the pressure of correct spelling and grammar from the other students, freeing them to think and express their ideas in a more relaxed fashion.

Students assemble in small groups to develop collective answers about the reading material. To compensate for slower learners who generally read below grade level, have the material read aloud by one of the better readers, or be sure the reading level is appropriate.

As students are actively involved in teaching themselves, the teacher monitors each group. After students have answered their questions, the teacher conducts a large group sharing session, calling on members from each group for responses. The teacher then reinforces, clarifies, challenges, and extends group learning. It is here that critical attributes can be emphasized, written on the board, and copied into notes, providing for reinforcement and reteaching as part of the learning process.

Two Techniques for Small Groups: Team Learning and Group Analysis

Team learning and group analysis are two small group instructional techniques that match classroom conditions and the learning style preferences of slower learners. They can be used to reach and extend the potential of slower learners in regular classroom environments. *(Dunn & Dunn)* Both team learning and group analysis are generic techniques that can be applied to subject matter at any grade.

Team Learning

Team learning is an effective technique for introducing new material to students within small groups. The teacher determines assignments. For elementary students the assignment could be reading a few simple paragraphs, perhaps with an illustration or two. For high school students, it could be reading designated material from a text with a lower or appropriate readability level.

Then the teacher prepares a series of questions; some answers are found in the reading material, while others require group discussion and interaction before the students reach agreement. Questions are purposefully designed to extend thinking by eliciting responses that move up Bloom's taxonomy, from knowledge or fact questions, to those that require analysis, inference, or evaluation.

In the last question, which requires evaluation, students are asked to demonstrate their comprehension by applying new information in a creative way, such as writing a collective poem, or developing a chart, skit, or other creative demonstration appropriate to the material.

Group Analysis

Group analysis and team learning are identical techniques; the difference comes in the type of material to be analyzed and the level of questions asked—questions requiring higher order analysis, synthesis, and evaluation skills.

Material may be anything students can analyze collectively: writing errors or styles, poetry, prose, literature, charts, graphs, tables, statistics; story problems in mathematics; historical outcomes, political cartoons; natural events, or science experiments, for example. Again, students must come to consensus on their group answers, requiring the sharing of ideas and perspectives and greatly enriching the learning experience. The recorder writes the group's responses.

The teacher then conducts large group sharing to summarize, reinforce, and extend learning. Requiring students to be ready to give reasons for their answers develops skills in logical thinking.

Group analysis and team learning are identical techniques; the difference comes in the type of material to be analyzed and the level of questions asked—questions requiring higher order analysis, synthesis, and evaluation skills.

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Resource List:

The Center for Slower Learners is a non-profit resource agency for parents and teachers of slower learners, offering a wide range of printed materials, teacher inservice sessions, and AAT workshops. The address and phone number are: The Center for Slower Learners, #20, 1122 North Alma, Richardson, TX 75081, (214) 480-9202.

Are There More Proven Techniques for Slow Learners?

Many other small group techniques such as brainstorming, role playing, or simulating extend student thinking and successfully include slower learners. *(Dunn & Dunn)* These techniques represent critical opportunities for active learning, peer modeling, reteaching, and acceptance in a non-threatening format—a learning style match that can make a difference in attitudes, behaviors, and mastery.

All of these activities are equally valuable for students who learn easily, offering welcomed variety in learning. They are motivating, allowing students to extend and expand boundaries—and they are fun. Departmental meetings can be used to share or brainstorm and develop other active, peer-oriented, multi-sensory approaches that include and encourage the slower learner—and include and encourage everyone.

VOCATIONAL AND ACADEMIC EDUCATION JOIN HANDS TO NURTURE STUDENT THINKING

Written by Mary Hendrix
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Tony, eyes shining with wonder and enthusiasm, looked at me and exclaimed, "I never understood why I needed to know how to add fractions until I did this!" Tony was an eighth-grade student enrolled in a career investigation course. He had just completed an activity that simulated the work tasks of a gourmet chef.

Tony is not unique. Most students don't understand how the facts and skills they are taught in school relate to their lives. "Why do I need this?" is a question every teacher has heard.

Not only are students questioning the worth of minimum skills, they also are having trouble mastering them. Is it because the intelligence of the current generation of students is faltering? Not likely. Rather, it is because we have become so concerned with accountability that we have lost teaching spontaneity—the natural tendency exhibited by effective teachers to create opportunities for students to interpret, plan, question, and evaluate. The emphasis placed on mastery of the Texas Educational Assessment of Minimum Skills (TEAMS) test has left many teachers with neither time nor energy to do more than present material at the lowest level of thinking: knowledge.

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Because the "correct answer" seems to be the ultimate curricular goal, students are given few opportunities to exercise their reasoning skills. Many students like Tony spend their time recalling processes, steps, and procedures, while educators ignore the relevance of learning. Just as we did when we were in school, students want and deserve an answer to: "Why do I need this?"

Nationally, less than 40 percent of high school graduates are able to demonstrate higher level thinking skills. *(Day)* And, closer to home, results of the 1985-86 TEAMS test indicate that the objectives mastered

by less than 70 percent of the student population are those requiring higher level thinking, such as drawing conclusions, sequencing events, identifying cause and effect, and solving word problems. What actions can school districts take to ensure that students not only master minimum skills, but also acquire those higher level thinking skills that will equip them to interpret, plan, question, and evaluate throughout their lives? Is it realistic for educators to hope to achieve both? Research indicates it is.

What Local School Districts Can Do

Because research indicates that most thirteen-year-old students are able to reason at the formal operational level, grades 7 and 8 should be especially targeted for implementing programs or teaching strategies that can help these students. Although higher level thinking skills should be addressed across the middle school curriculum, often it is difficult for teachers to locate materials that are relevant and reach beyond the comprehension level of learning.

In addition, most textbooks and supplemental instructional materials are written for middle schools with the assumption that instruction will be presented to students in the following manner: (1) The teacher explains or defines the concept. (2) The student uses the concept in one or two written exercises. (3) The student is tested on the concept. Although this traditional method can be said to use time efficiently, it is not always effective academically. *(Hawley and Rosenholtz)* Students seemingly may have mastered a curriculum objective, yet retention of the skills they have mastered is not always evident several weeks after completing tests. *(Brazee)* It is critical that teachers make lesson objectives relevant to the lives of students and that they provide opportunities for students to use their skills in as many cognitive levels as possible.

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Why Career Investigation is Successful

Career investigation, a program that emphasizes the inter-relatedness of all academic courses with practical life situations, not only boosts academic performance, it equips students with problem-solving and critical-thinking skills that transcend the secondary school. It is an effective, successful program for three reasons:

- The program recognizes that problem-solving skills are needed to make career decisions and choices throughout an individual's lifetime.
- It provides experience for students to explore, expand, and enrich their abilities to make meaningful, well-informed career decisions.
- It infuses basic skills applications into its curriculum.

Contrary to the common misperception that "vocational" means "trades only," career investigation students are introduced to careers in every field of work, from business and industry to the professions.

Students analyze various, diverse careers and identify and apply the basic skills needed to succeed in those careers. As in Tony's case, students not only use basic skills, they begin to value them. Tony, for example, realized he could use two, ¼ cups or one, ½ cup to measure sugar for a recipe.

Application is crucial to basic skills attainment—concrete thinkers receive practice using a concept, and formal thinkers use the same concept in a more abstract and sophisticated way. The instructional materials for career investigation emphasize each of the objectives addressed in the seventh and ninth grade TEAMS tests, but use untraditional approaches like practical application, analysis, synthesis, and evaluation. While studying career opportunities in hospitality and recreation, for example, students are asked to simulate the duties of a travel agent. Using travel brochures, personal contacts, and other resources, they plan an itinerary for a customer including all information necessary for an enjoyable trip, while keeping expenses within a pre-determined range.

This activity may sound like nothing more than a game to some. The catch is, though, that while having fun, students are engaged in the practical application of skills assessed by seventh grade TEAMS: word problems, charts and graphs, equations, context clues, sequencing events, reference, graphic sources, and others. And, in addition, they are applying concepts associated with the following areas of cognitive development: correlational reasoning, frames of reference, classification, spatial-temporal relationships, and formed logic. *(Fusco)*

Career Investigation Curriculum

The career investigation course curriculum includes four areas of study:

Self-Appraisal
Students identify, analyze, and evaluate their interests, abilities, aptitudes, social and emotional needs, and lifestyle needs and aspirations.

Career Opportunities
Students actually simulate the work tasks of career opportunities. They not only experience the importance of acquiring basic skills, they also apply them in a variety of ways from simple application, to analyzing, synthesizing, and evaluating a basic skills objective. The career areas investigated are: agribusiness and natural resources, business and office, communications and media, construction, consumer and homemaking, environment, fine arts and humanities, health, hospitality and recreation, manufacturing, marine science, personal service, public service, and transportation.

Economic and Societal Factors
Students study the function of work in our economy and society, the acquisition of job skills, the effect of technology on the work force, and the dynamics of on-the-job relations.

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Educational and Career Planning
Students are given opportunities to acquire the problem-solving skills needed to synthesize information learned in the course. Thus, they are equipped with the skills and information they need to make decisions about their future educational or training plans in their chosen field.

Although career investigation is by no means a panacea, when career investigation teachers collaborate with academic teachers, significant gains in student achievement are evident. The career investigation course, however, is meant to supplement, not supplant, higher level thinking skills instruction in other courses offered in the middle school curriculum. Because of limited time, resources, and training in career guidance, academic teachers cannot possibly tailor every lesson to simulate the job duties of career opportunities. They can, however, incorporate many of the same effective strategies, some of which follow.

Strategies for Nurturing Higher-Level Thinking Skills

- Relate each skill or concept being taught to practical life situations. Answer the students' question: "Why do I have to know this?"
- Make word problems and assignments personal and relevant to the lives of middle school students. For example, one activity in the Career Investigation Curriculum Guide calls for students to simulate the work tasks of careers in transportation by figuring mileage, determining total expenses, and plotting the route of concert tours performed by Bon Jovi, a popular rock group.
- Allow students to create alternative procedures for solving problems. For years, we have told students there is only one way to find an answer. Students enjoy not only finding alternative procedures but also alternative answers.
- Utilize interactive teaching practices. Instructional strategies should vary from lesson to lesson. Group discussions, inquiry learning, teamwork, and peer tutoring all convey information.
- Allow students to use their existing knowledge and experiences to solve current problems. Make use of and enforce the importance of prerequisite skills and previously learned information.
- Encourage students to ask relevant questions. Praise them when they do.
- When appropriate, present students with case studies of well-known, effective thinkers. The Career Investigation Curriculum Guide provides daily lesson plans that begin with a sponge activity consisting of a quote related to the lesson. If, for example, the lesson deals with assessing individual abilities, begin with a sponge activity that has students interpret Will Rogers' quote: "Everyone is ignorant, only on different subjects." Relate this quote to the lesson by emphasizing that students have different strengths.

Career investigation, a program that emphasizes the interrelatedness of all academic courses with practical life situations, not only boosts academic performance, it equips students with problem-solving and critical-thinking skills that transcend the secondary school.

Conclusion

Most educators realize that minimum skills testing is not in itself an adequate measure of learning. When efforts are focused on preparing students to master minimum competencies, less time is devoted to developing the higher level thinking skills.

If students are to succeed in both minimum skills mastery and higher level thinking skills attainment, they must be afforded opportunities to apply both in many learning situations, starting at the earliest age at which formal thinking occurs. This fact, correspondingly, creates curriculum implications for the middle schools.

It is time we demolished the wall that has separated academic and vocational education. Initiating exemplary course offerings such as career investigation can provide students like Tony with opportunities not only to increase their academic performance, but also to understand and value the relevance of doing so. Indeed, vocational and academic education can join hands to prepare a generation of students for a smooth transition from school to society—by equipping them with both the basic knowledge and higher level thinking skills needed for successful pursuit of their goals.

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For information about the career investigation course, contact Sylvia Clark, Occupational Education Specialist, Vocational Guidance Programs, Texas Education Agency, at (512) 463-9443.

For information about instructional materials for career investigation, contact the Occupational Curriculum Laboratory, East Texas State University, at (214) 886-5038.

COMPLIANCE STATEMENT

TITLE VI, CIVIL RIGHTS ACT OF 1964; THE MODIFIED COURT ORDER, CIVIL ACTION 5281, FEDERAL DISTRICT COURT, EASTERN DISTRICT OF TEXAS, TYLER DIVISION

Reviews of local education agencies pertaining to compliance with Title VI Civil Rights Act of 1964 and with specific requirements of the Modified Court Order, Civil Action No. 5281, Federal District Court, Eastern District of Texas, Tyler Division are conducted periodically by staff representatives of the Texas Education Agency. These reviews cover at least the following policies and practices:

(1) acceptance policies on student transfers from other school districts;

(2) operation of school bus routes or runs on a non-segregated basis;

(3) nondiscrimination in extracurricular activities and the use of school facilities;

(4) nondiscriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;

(5) enrollment and assignment of students without discrimination on the basis of race, color, or national origin;

(6) nondiscriminatory practices relating to the use of a student's first language; and

(7) evidence of published procedures for hearing complaints and grievances.

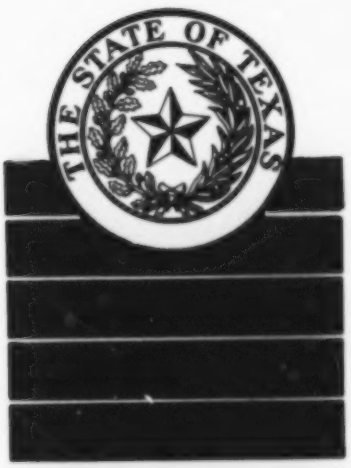
In addition to conducting reviews, the Texas Education Agency staff representatives check complaints of discrimination made by a citizen or citizens residing in a school district where it is alleged discriminatory practices have occurred or are occurring.

Where a violation of Title VI of the Civil Rights Act is found, the findings are reported to the Office for Civil Rights, U.S. Department of Education.

If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

TITLE VII, CIVIL RIGHTS ACT OF 1964; EXECUTIVE ORDERS 11246 AND 11375; TITLE IX, 1973 EDUCATION AMENDMENTS; REHABILITATION ACT OF 1973 AS AMENDED; 1974 AMENDMENTS TO THE WAGE-HOUR LAW EXPANDING THE AGE DISCRIMINATION IN EMPLOYMENT ACT OF 1967; AND VIETNAM ERA VETERANS READJUSTMENT ASSISTANCE ACT OF 1972 AS AMENDED IN 1974.

It is the policy of the Texas Education Agency to comply fully with the nondiscrimination provisions of all federal and state laws and regulations by assuring that no person shall be excluded from consideration for recruitment, selection, appointment, training, promotion, retention, or any other personnel action, or be denied any benefits or participation in any programs or activities which it operates on the grounds of race, religion, color, national origin, sex, handicap, age, or veteran status (except where age, sex, or handicap constitute a bona fide occupational qualification necessary to proper and efficient administration). The Texas Education Agency makes positive efforts to employ and advance in employment all protected groups.



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